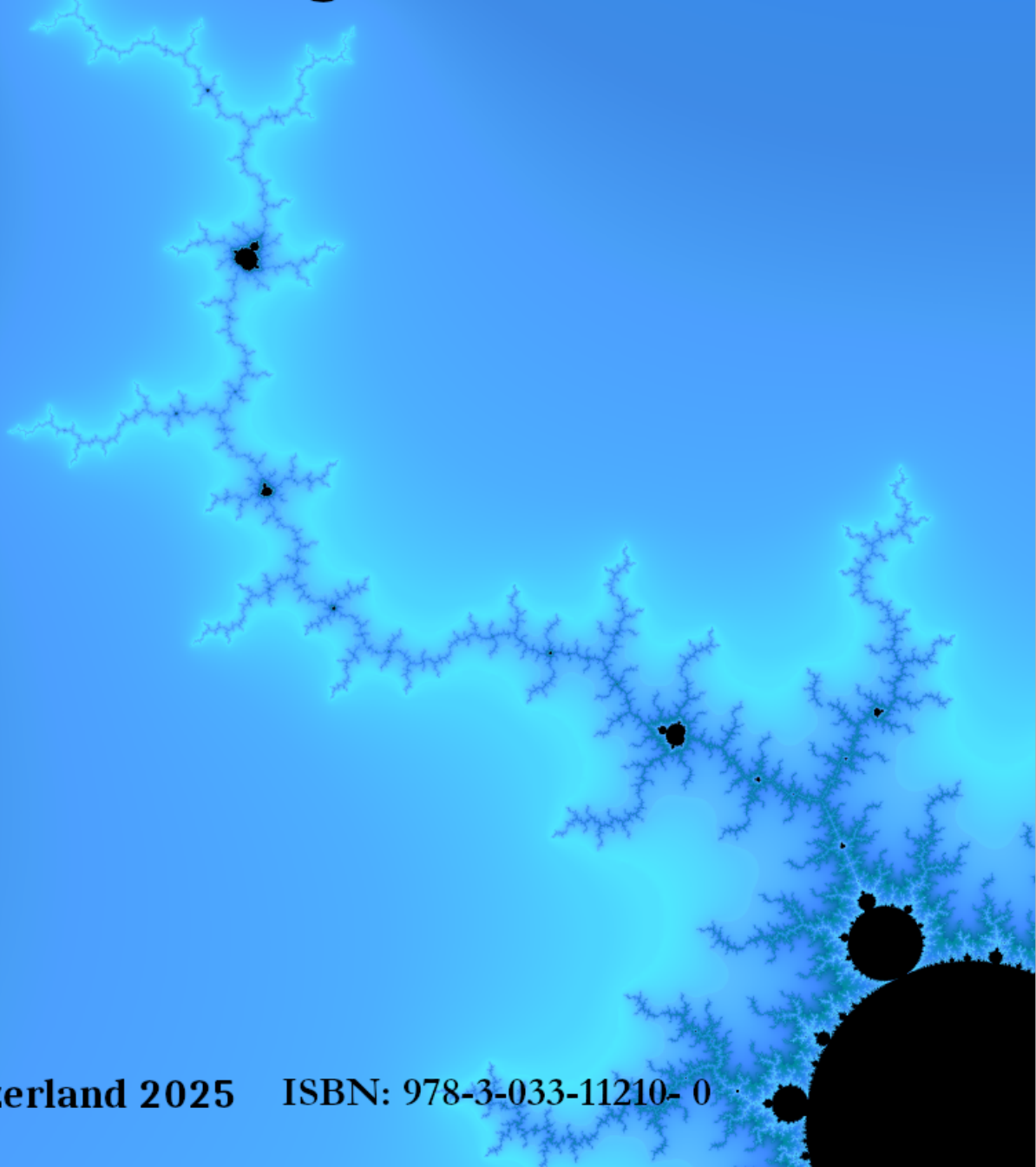
Elements of Science and Elements of Latex

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BEng, MSc



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Elements of Science and Elements of Latex

Christopher Neufelt

Burgdorf Switzerland, March 31, 2025

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About the Author

Neufelt Christopher. Born in 1974. Bachelor in Electronics- and ComputerEngineering, University of Brighton 2001. Master of Science in Mechatronics, DeMontfort University 2005. Minor Certifications since. He is married, has Kids, lives in Burgdorf, Switzerland.

Interests: VHDL, Science as Discipline, applied Mathematics, Physics, "Matlab"-Variants, European History, Complex Systems in particular ControlTheory as applied in Societies under Stress, SignalDetection for paranormal Activities, Felines (Quadrupeds as well Bipeds), Smell of pure Cavendish Tobacco [1] and sweet Rum.

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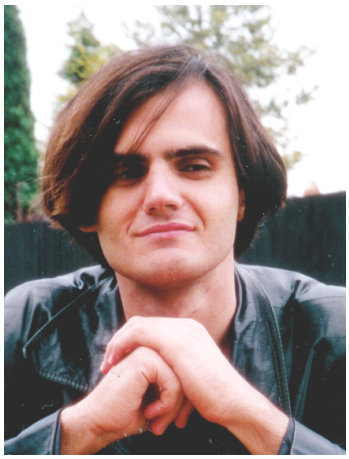


Figure 1: The Author, circa 1999.

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Dedication

This Work is dedicated to my Wife and my Kids.

[1] I have quit Smocking many Years and just by breathing it I can fall on the Ground, but the pure Cavendish Tobacco when burns is a pure Magic to my Nose. "CigaretteTobacco"-Smell is something I detest.

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Front Image

The front Image is a Part of a "Mandelbrot"-Fractal. While Order can be considered the opposite of Chaos, in my Experience, Order is the Attempt to control Chaos. Since Science is one of three Tools we can use to control Chaos, I colored the Fractal with the original Colors of Sky, which for me are the Colors of Clarity, as well the FoundationColors of my Continent, Europe.

Supporting the Author

If you would like to support the Author, Neufelt Christopher, for this Project and future Projects on scientific Education, I provide my Address for a Meeting.

Directives for Printing

I designed this Book for A4 Paper and therefore the Printing of this Book should be on A4 Paper. This Size was very carefully considered, since it provides as Size-Format an available Margin which is good enough for writing Notes, as well as a good Readability even for Readers with Glasses that can read a Text of 10pt FontSize.

Suggestions and DeathThreats

Suggestions and DeathThreats are always welcomed, with DeathThreats forwarded to the Police because I cannot afford to have them sitting all the Time doing nothing. "Dead"-Seriously. Suggestions are a Bit of problematic since the Connoisseur finds the Errors while the Amateur wants to demonstrates his nonexisting Intellect: its easy to locate a Piece of Garbage in a Mountain, than to create a Mountain. Anyway, any Suggestion that can make this Document better or at least more efficiently torturing the Reader is welcome. Please send Suggestions with the Post. A Card is always a great Present for me.

Conventions to this Text

I had to create some Conventions here, some of which, are intended to correct the Problem of forcing the Context in an already overloaded Language, the English Language, as well as the linguistic Pollution from my Side (English is not my MotherLanguage) since I describe this Work in a "non Mother"-Tongue.

The English Language is a Germanic Language which during its Development got dangerously simplified from foreign Populations as well as historical, social and technological Changes. Its a beautiful Language if you have been raised in the English Countryside or you have English Parents with some decent Education [2] .

The Problem with me is that I am neurodivergent and I have MemoryDysregulation. If you think this Document is well structured is not, even if I have spend my free Time on it; however I tried to make it structured *according to my personal linguistic Capacity as well intellectual Performance.*.

- **Nouns, Acronyms and national Adjectives** are capitalized on the first Character. E.g. Love, EU, German Character.
- **Gerunds**, that is Verbs that act as Nouns, are also capitalized when they are used as Nouns. E.g. the Phrase "The Planning comes from the Demand." has the Gerund the Verb "Planning". Under normal Operations I try to avoid to Capitalize Gerunds if Prepositions force them to act as Verbs. E.g. the Phrase "The Planning comes from the Demand for repairing the Housing." has the Gerund "repairing" not capitalized since it acts as a Verb.
- **Prepositional Phrases** have their Noun non capitalized, e.g. in Phrase "Things to be done in order to attain the Target", the prepositional Phrase "in order" has its Noun non capitalized.
- **CompoundWords**: Typically in English Language the GenitiveCase is used to denote Possession as "File's Name" and "History's Lesson" with the Tendency to write currently "file name" and "history lesson"; using the possessive Preposition "of" it could be "name of file" or "lesson of history". Because the Reference by using more than two Nouns add always a higher Dimension of Reference (i.e. The Window of Door of Car), this Text writes the Words as CompoundWords e.g. "FileName", "HistoryLesson" for "Name of File" and "Lesson of History". However when one Noun is quoted, it has something Special to denote. dashed, e.g. "Laplace"-Force. More than two Words are quoted only as Phrase or as Nouns as such to make the Content understood on its Parts, e.g. "straight line"-Approximation, concerns the Approx-

[2] Despite the mental Masturbation of the Media, an Education is not a good academic Performance, but how much a Person is ready to learn! The most capable Writers do not need to go to University to study Literature and Language; they have home a good Library of Books that are carefully written and these Books are the Material that the Writers learned to understand. The same goes to Parents, who didn't go to the University but learned to learn and infused this Concept to their Kids.

imation of a straight Line. Further Directives are encountered in the Section "CompoundWords" in the LanguageSection of this Book. For burning the Witch (me, that is), I am available Sunday after the Church.

- **Emphasis**, something that you want the Reader to especially notice, is given with various ways:
  - **Bold Fonts** denote Terms typically first encountered. E.g. *...In the Manual for industrial Design we often speak of* ***Constraints****. Constraints are Restrictions in the Flow of Design....* The whole Idea of the bold Font is that will visually attract the Reader to the first Encounter with the Word he is interested. E.g. Joe has **Alzheimer** since two years.
  - Another use of bold Font is to warn the Reader for something. E.g. Attempting to solve this Problem will eventually force the User to Error: **Do not attempt to solve this Problem!**
  - *Italic Fonts* (Characters inclined with respect to the Rest of Text) denote the linguistic Aspect of **Emphasis**. E.g. This has nothing to do with the current State of Affairs but rather with *the Idea of controlling Reality.*
  - When a **new Term** or a **phrasal Term** or a **complicated Term** is referred in the Text will often be quoted. E.g. The Term "PerformanceRatio" refers to a Ratio of Variable B divided by Variable C. In this Way, the Focus on the Term, rather than the *false Integration of Meaning of the Term* is maintained. E.g Compare:
    - The Term Call is used to call a Routine
    - The Term "Call" is used to call a Routine
- The **"a"** is avoided when we refer to items such as items A, B, C since it makes difficult the Memorization linguistically: Many people narrate within themselves the Reading and confuse the Semantics of the Sentence.
- **I try the Use of the Pronoun "I" and not "We" as I hold Responsibility for this Text.** Typically in scientific Texts, the word "I" is avoided in Order to share Responsibility in Case of Error. As far as I am concerned, if the people want to fuck you, the "We" does not apply: *they will fuck you anyway.*
- **The Pronoun for a Student in this Book is "he", for keeping the Tradition of Scientist (Male) and Science(Female) in the Sense that the Mother gives Birth to a Kid** [3] .
- **Humor**: From Time to Time, I make Jokes for everyone, including the removal of Hope from the Reader. Don't take them seriously! The Ability to joke or even deride someone is a fundamental Aspect of the HumanPsyche and its fair. To avoid

[3] In our Times is seems that the IdentityIssues that mainly ensure in the Cities, not in the more healthy Countryside, are the most important. Unfortunately the People behind these IdentityIssues, are more eager play a Victim, create a Charity and getting rich from the Charity, instead of solving real LifeProblems (you can check yourself how much rich are these People). In most if not all European Languages, a Title, i.e. Student, was awarded a MalePronoun, while the Sciences have a FemalePronoun; this has nothing to do with IdentityIssues. It has to do with neurolinguistic and cultural Issues that endure in the LanguageDevelopment for thousand of Years. If you want to fight real GenderProblems, look who's considers Women as Items and Homosexuals as not Human and make your Choice: for me Women and Homosexuals are People that I love and deeply respect; I don't waste my Time with Trivialities that some paid morons created out of thin Air.

it is unfair; I will not analyze further the philosophical Implications of this Statement, since Failure to understand it, means that you are Idiot (I still love you though!). However if you are, I will not judge the ContraceptionStrategy of your Parents, though everyone will agree that it failed.

Questions and Exercises: Answer the questions with your own words without taking much care of the scientific jargon: Understanding here is a Virtue.

Concerning Use of Computer: use Paper when is demanded, use Computer when is demanded. Building Habits is here a Virtue.

Preface

This Book was created for two Audiences. The first Audience are People are interested for Science as an applied World-View. These People are perhaps Students or just normal Readers that have the Interest to explore the Parts of Science that they get from Media. The second Audience are People that are working as Scientists. These People have their Concepts and Expectations of what Science is and how Science binds to their scientific Endeavor; and here comes me, an Engineer to preach to old Giants of what a Dwarf believes about what Science is!

This Book was actually created for the second Kind of People and has the Purpose to provide a FrameWork where these People can place their Experience, Knowledge and Wisdom within my FrameWork and then adapt, create or even destroy my FrameWork. On the Way, they will have to consider and perhaps reconsider their Concept of what Science is. I am open for Discussion or even for a Burning of the Witch if my FrameWork is false. This what is Science all about: Developing, Destroying and Redeveloping. In the Breaks some Time for Contemplation, Rum and Friendships.

An Element is just a Part: whether of a chemical Substance, a Machine or a Personality. The Term "Element" on Titles has been in Use at least 200 Years, and now again, by me. As a Term defines "Parts" of Knowledge, not a complete Coverage; consequently it is the only Term that can define my Effort: to give to the Reader what I learned and what I studied. **First of all I am not a Scientist! (Though I have my Bachelor in Engineering and some Poststudies) I created this Book, in order to record my Efforts of understanding Mathematics and Science for the Purpose of solving real Problems affecting real People. However, nothing is perfect, this Book, or worst, me.**

I have **Attention Deficit Hyperactivity Disorder, (real and difficult Case)** and I also belong to the **Autistic Spectrum** in the Sense of **Asperger Syndrome**. I was diagnosed in 2021. I am also **dyslexic**, and I suffer from **Depression** (not severe, there is no hope ☺). Its precisely my neurological Conditions that created the Thirst to understand the World, and in particular applied Sciences, in a Sense that the Problem of understanding Science is at the same Time the Solution of understanding Science from the opposite View [4] .

Science is like a disabled Kid that you need to learn to love, in Order for that Kid to find its Way to flourish your World, your internal but also your external, the World that you live. Science, *likewise to the disabled Kid*, needs also Time. There will be Times that is difficult or even impossible to handle the Kid. The Remedy for these Times, is to skip them and visit them later, sometimes much later, in order to continue with other Tasks concerning again this Kid. Once the Kid has grown and is independent, you can continue with the Care of other disabled Kids, until you are fit enough to consider your attained Wis-

[4] This View of the Problem to be a Solution, is also the current View of autistic Disorders, since there is the Suspicion that autistic Disorders are evolutionary Trait that does not adapt well to our current Norms as a Society.

dom. *By the way, the Kid is also you.*

The Resources that I used to build this Work (I call it by my Criteria "Opus") are given in the Bibliography, and my Pathway to create this Book was **to walk in the Shoulders of Giants as Newton once said**. A syntactic and "by content"-Analysis will reveal precisely my Effort; Credit, Citations and Bibliography are given where I could find. The DefinitionProcess that I use, I describe in the Appendix, in the Section for the Requirements of this Book.

I provide also a List of **suggested Books on the Subjects**.

I love you

Chris Neufelt

P.S.1: The Jokes in this Book serve the Journey to Learning, i.e. make the Progress of Learning enjoyable. Here the Jokes are not political correct, but then again *political Correctness is for "Pussies"*. If you accepted a "Covid"-Vaccination with no Room for Scrutiny or legal Prosecution of 80 Years for the People that created it, then you are Adult enough to accept AdultJokes; at least the Jokes will not kill you or disturb your obedient Mind.

P.S.2: A Situation that I accepted writing this Book is that my Content might be false. I accept this because this is for me a Victory if someone finds the Error and propose a Solution, i.e. consequently a better Content.

P.S.3: The Term "Elements" refer to various Parts of a Science. In the Case of this Book, I cannot provide a complete Coverage of any Subject, this is why the Term "Elements" was the most appropriate.

P.S.4: How can you say "I love you" to People you don't know, which most of them identify even as Males? Easy! Humans are social Creatures and need each Other, starting from the disabled Person that needs a Carer, and ending up to a Friend that needs a Friend. That I can manifest my Love for the People, this perhaps has to do with my social Intelligence; if you are looking for the Word "Love" as Synonymous to sexual Activity, no it is not! Saying that, I find more disturbing a Person that adores Money, than a Person that adores any other Person, even on the sexual Domain; you are either a Human or not!

P.S.5: This Work it will always be Work in Progress. Subjects that were not ready they have the Notation "TBD", i.e. to be defined. I had to cut my further Effort on this Book due to Problems that I hope to discuss in the Future, so this Book is not perfect, sorry. The second Edition of this Book will contain more Books on various Subjects as well as Amendments and ReaderFeedback.

P.S.6: This Work contains in Latex many Packages and consequently is **very** heavy as a "Software based"-Text. Actually many Cuts had to be made, my Memory as well constant Migraines didn't help. While Latex is actually for Software very Stable, its Documentation is somewhat problematic and this Situation was the Impetus of writing about Latex; to solve my own MemoryProblems.

Part: Science

Chapter 1

Word and Definition

Narrative

In Science every Word has a special Meaning and "Weight", i.e. Importance, concerning its Use. However it is frequently overlooked the Issue of Meaning, that is, *the correct Meaning*. For this, the Science laid a Foundation for using the correct Words and this Foundation is here explored. The Foundation is the **Term** and its **Definition**.

1.1 The Word and Definition

We use Words to describe Everything and some Words give us additional Precision on the Description of Everything.

Def. 1.1.0.1*:* **Word, De. Das Wort, Gr. ἡ Λέξις, hee Lexis:** is the smallest Unit of identifiable Information

Since *the Word* ***is*** *Information*, the Word is transmitted and received from a Person to another. The Word is made from a meaningful Collection of Human-Sounds (AKA Linguistic Voices) or written Symbols (called Characters) that represents the Information. E.g. **Car, Person, Eagle, Life, is, exclusively, beautiful, no, over**, are all Words.

In Science, Words need to be explained before used, so that the next Scientist that will carry the Work, will have a **common Understanding** with the developed Concept. The **ExplanationProcess of the required Word AKA Explaining-Steps** is done in an official Way, by:

1. writing precisely the required *Word*, and then
2. providing its *Explanation*
3. providing the *Examples of Use of the required Word* and finally,
4. providing the *Evidence* of the required Word if any.

What we want to explain, needs to be very well explained, and not diverging from our Focus. Consequently, we must explain the Tools that will help us to explain the required Words: the main Tools are the *Term and Definition*.

Def. 1.1.0.2*:* **Term, De. Die Bezeichnung, Gr.ὁ ὅρος, ho Horos:** is an official Name used under a common Agreement by the WordUsers.

The "Term" as a Word is overloaded, but for our purpose it signifies a Word that is used to mean the same Thing between the WordUsers.

E.g. A *"Polyonym"* is a Word that describes a mathematical concept. The PeopleCommunity that uses this Word acknowledges the existence of this Word and employs the Word in Mathematics as a Term.

Associated with the "Term" is its Meaning, which is given by the "Definition".

Def. 1.1.0.3*:* **Definition (First Attempt), De. Die Definition, Gr. ὁ Ὁρισμός, ho Horismos:** is called a Sentence that describes in a formal Way a required Word

Typically a Definition is used to explain a Term. However, every single Language-Dictionary provides a Definition of a Word for common Use. This Definition is an Explanation that covers very widely the Word, thus the Word "Explanation" is more appropriate instead of "Definition", but this is what we have since the Definition is used for very specific Interpretations, while the Explanation is covers general Interpretations. Consider the following examples:

E.g. In a Common Dictionary the Term "Trap":

Trap: is any Device or Situation which impedes and immobilizes something.

E.g. Dictionary of military traps:

Trap: is any device that impedes or kills adversary personnel.

The common Definition of Trap concerns everything that can impedes something. This "Everything" is very general. In Comparison, the MilitaryDefinition concerns actual tangible Devices that can either impede or even kill, and consequently is very specific Definition.

Another Use of Definition is very important to the Research: a Definition serves as a short Text to remind you something Important. Saying that, *the Definition describes briefly the Term, does not explore the Term*: it is your Job to study the Term, but the Definition is simple a reminder about the Term.

Remark 1.1.0.1. Uses of Definition

The Definition is used as a short Description of a Term and as a brief Reminder about the Term.

Remark 1.1.0.2. Explanation and Definition

A DictionaryExplanation is elastic, i.e. covers many Scenarios and Interpretation while a DictionaryDefinition is very static, i.e. covers few Scenarios and has a fixed Interpretation.

Questions

1. What is "Word"?
2. What is "Term"?
3. What is "Definition"?
4. Define the ExplainingSteps of the required Word.
5. Using the ExplainingSteps of the required Word, define the Word "Automobile" AKA "Car". Do this Work maximum 5 Minutes for this Exercise. The Exercise is free on its Content, so there are only commonly conceived Answers. This is an important Exercise since in your Career as Citizen or Scientist you need to explain Something precisely, especially in a critical Situation such as your Contact with an Authority or a StakeHolder. Even a Prostitute does not know all the Terms that you got by watching Porn, so it is good to be able to explain.

1.2 Formulation and Definition

The TermUse in Science must be made in an official Manner, that will have a clear Understanding by the Stakeholders of the Term, leaving no Space for Ambiguity. Some Understanding of the previous Sentence is important: having a Term and its Definition is important, but you need to use the Term, as well display it, in an appropriate Manner. This official Manner is called "**formal**".

Def. 1.2.0.1*:* **formal (adjective), de. formal, gr. ἐπίσημος:** is describing something in an official or appropriate Way.

The opposite of "formal" (its antonym) is "informal", de. informel, gr. ἀνεπίσημος.

E.g. The formal Description of a Worker is a Person that carries out a Task.

In this example, the Term "Worker" is defined as a Person that carries out a Task, but notice that the Term "Worker" was described in very specific Words. Compare the following *informal Description* of Worker:

E.g. The informal Description of a Worker is someone that works.

In this Description the Word "works", does not tell us anything more about the Worker; however it might be easier to use in a Conversation between either very clever people (who speak of the same Context) or Idiots (not between Idiot and Clever though!) as long as the informal Description is understood in its most simple Description.

Comparing the formal and informal Description, we notice that the formal Description is more understandable while the informal Description is more vague: this is due to the specifics of the Descriptions. The formal Description gives Information in a sense of covering all the Concepts of the required Word, while the informal Description gives Information in a Sense that refers back to the Noun (compare "Worker" and "works").

Speaking of formal Descriptions, we must consider the Precision that we describe the Term. This Precision, called "Formulation", needs to cover all the necessary Parts of the Term and is a Process of your Work that can actually take Time.

Def. 1.2.0.2*:* **Formulation:** is the ExpressingProcess of the inner Details of a Concept.

The required Concept can be an Idea or a Process on its own Right. The Verb associated with the Word is **formulate**.

E.g. Formulate the Process of Boiling the Water. *Formulation of Boiling the Water*: We take a Pan, we fill it with Water, we place it on an HeatPlate, we activate the HeatPlate, we observe the Process of Heating where Water starts to gain Temperature until it boils.

Please notice that when you are working as a Scientist, you know your Work, and you merely describe correctly what you Study.

Having the Term and its Formulation, we need to cover a Word that we will very often use. This is the Word "Process". A Process is nothing else than an area where Something occurs in well defined Steps.

Def. 1.2.0.3*:* **Process:** is a Set of ordered Actions that cooperate between them to achieve a Result.

A Result can be tangible or intangible, like an Object or like a Situation or an Information. Worth to know here, is that the **Process can be mental**, i.e. an intelligent Being thinks and creates Information, or **physical** i.e. a Machine acquires Materials and produces Objects.

Returning to the "Term", we need to write clearly what we want to write for the Term; we need to state the Term. To state the Term, we use one or more well defined Sentences, called "Statement".

Def. 1.2.0.4*:* **Statement:** is a linguistic Expression with a descriptive Content.

The Statement is a linguistic Expression (i.e. a Sentence) that describes something, but does not expresses the State of something.

E.g. Rome is the Capital City of Italy.

However, some Expressions are not descriptive and thus are not Statements regarding our Definition!

E.g. Wow! E.g. Sam? E.g. I love.

Frequently the linguistic Expression "Statement of something" appears in Sciences. E.g. Statement of Equality. This linguistic Expression simple describes that the second Noun (here: Equality) in the Expression, is perceived as a Statement on its own Right. E.g. A *Statement of Equality*, means a Statement that de-

scribes Equality. In this case, the Statement can be a mathematical or scientific Expression that describes a Statement. E.g. B=C is a Statement of Equality between B and C where the Symbol "=" states Equality, that is, "=" is a Statement itself.

Declaring a Statement on Paper is typically done by the Character "S" followed by a Number and the "equals"-Sign and then followed by DoubleQuotes that include the Statement [1] .

E.g. **S166:="The car is parked near the Theater"**

However you should remember to write at the DocumentFront the Conventions for such an Acronym since *Common Sense is frequently non-common*, and the People tend to misinterpret Data according to their Views.

Knowing now how to formally state the Term, we described it in a formal Way by a *Definition*. Here is the official Definition of **Definition**(WTF!).

Def. 1.2.0.5*:* **Definition (formally), De. Die Definition, Gr. ὁ Ὁρισμός, ho Horismos:** is a formal Statement of the TermDescription

Typically a Definition [2] is formulated as a Sequence of the following Words: "**Term**: **Description as a Sentence**", often accompanied by one or more Examples that clarify the Formulation.

E.g. The Definition of Car:

Car:*is a vehicle with wheels used to transport persons and cargo.* E.g. A Volkswagen Polo is a Car.

There are some Issues concerning the Term "Definition".

- The Word "**IS**" [3] in a Definition is an Identification for a Synonym [4] of the Term that follows. The Synonym might be close or almost identical to the Term; Having different Words you can convey by Comparison a Meaning [5] However, the Synonym is not a Panacea [6] to the Definition. The Definition requires Explanation and frequently one or more examples [7] .

- The Definition might be problematic or even non-correct. The Reader should use his personal Judgment for the DefinitionValidity. In fact, if he has a better Definition, he should publish it. *Thank you in advance.*

- The Definition is used to fully describe something that is encountered within its valid Bounds. Therefore the Definition requires beforehand, the Identification of the valid Bounds. E.g. Is the Term relating to the StudyArea of Cooking? Does it enclose other StudyAreas? Should you define the Bounds of the Term only to the original Areas you research?

- Some Definitions can be independent i.e. do not rely on any other Reference, while other Definitions are dependent on other Definitions.

- Typically a Definition is denoted as **Def.Number**. In this text, a Definition is accompanied by a Number or a Word which can be used to refer to

[1] This Notation it might not be appropriate at the Time, since many Authors in Mathematics can use different Notations! However, this is what I learned to School.

[2] This is another Attempt to explain the Term "Definition", now by the Side of a more specific View, the ScienceView.

[3] This is the Verb "be" which is irregular in nature so it appears in various Forms that is why does not relate vocally to "IS".

[4] Synonyms for the Verb "is" are among others, the Verbs "express", "represent" among others (in this context).

[5] A **Synonym** is a Word with similar but often not equal Meaning with another Word (that is why there are differences). When we define a Word, we frequently use Synonyms, so that the reader can focus easier to the Term provided.

[6] a Remedy for Everything.

[7] Sometimes you can have more than one Definition; keep it like this, don't try to merge the Definitions; the Reasoning is that the Definition can provide a unique View of the Term which otherwise is not possible only with one Definition available.

it when needed. E.g. See Def.12, e.g. see Def.12 Principle of least Effort. [8]

A special Verb associated with the Term "Definition" is the Verb "define".

Def. 1.2.0.6*:* **Define (Verb):** is the Process of implementing a Definition.

Another Definition is the so called "**empirical Definition**".

Def. 1.2.0.7*:* **Empirical Definition:** is a Definition taken based on the Experience of the Researcher and it is based on Observation, Assumption and intelligent Guess.

The empirical Definition is the first Definition that a Researcher formulates to display his Term. Such a Definition does not last long; however is a first Step to the Journey of his Research.

1.2.1 Verbs for describing the Term

Describing the Term can be tricky, since you need to have the closest Description which might not be possible. There are two Approaches on this:

- **IdentityApproach**: If you describe the Term with a firm Description then you identify the Term with another Term or Sentence. In this case you can use the Verbs "**be**" and "**called**". This Approach gives a "close" to an exact Description.
- **SimilarityApproach**: If you describe the Term without a firm Description then you compare the Term with another Term or Sentence in a Sense of common Properties but not in the Sense of Identity. In this case you can use the phrasal Verbs "**pertain to**", "**refers to**", "**associated with**","**concerns with**", "**points to**", "**relates to**". This Approach gives a not exact Description but compares to a similar Term.

Typically as Scientists you develop a Term by the SimilarityApproach and once you get the Thing right, you start to work on an IdentityApproach. You cannot of course get the Term exact, since the Definition needs to be short and robust, the Use of the Term can change as well as the Language itself. Consequently the SimilarityApproach is closely related to the empirical Definition.

Needless to say, the IdentityApproach is something that can become satirical. E.g. What is a Woman? A Woman is a Woman [9] . Using the IdentityApproach to define something only by its own name, defeats the Reasoning behind a Definition: a Definition is a Description, not a Name per se!

1.2.2 Effort and Definition

A Definition is the Result of the Effort of the Scientist. However, the Effort might not be sufficient and many Definitions might appear. There might be many Definitions before a final Definition. A Definition that is not final is called "WorkingDefinition".

Def. 1.2.2.1*:* **WorkingDefinition:** is a Definition that is not final and reflects that Work needs to be done in order to provide a further Clarification.

Def. 1.2.2.2*:* **Final Definition:** is a Definition that is considered final regarding its Use in a TimeFrame and Scope.

Typically the Scientist will create a WorkingDefinition that will serve its Purpose on the short Duration of his Research. Once his Research is finished, he might or

[8] The Definitions of Terms in this Book: the Definitions are given officially within their Paragraph. Sometimes, I need to create *Flow of Reading* in order to keep the Reader focused. In this case I write the Definitions directly after the Paragraphs.

[9] Thank you very much for your intellectual Effort!

might not have a refined a WorkingDefinition to a final Definition, that is, he might well either rename his WorkingDefinition as Final or come with a FinalDefinition.

Questions

1. What is “Formal”?
2. What is “Formulation”?
3. What is “Process”?
4. Describe the Process of Mixing two Colors under 5minutes Time.
5. Describe the Process of asking a Permit to build a House under 5 minutes Time. Warning: this is a dangerous Exercise and can even cause sexual Disruption. No, this is not a joke: to gain a Permit can be a Hell.
6. What is a “Statement”?
7. What is a “Definition”?
8. How we denote a Definition?
9. What is the main Verb that we use in a Definition?
10. What means the verb “define”?
11. What means the “empirical Definition”?
12. What are the two Approaches for describing a Term?
13. Give a Verb for describing exact a Term.
14. Give a phrasal Verb for describing approximately a Term.
15. Define quick but exact the Terms: Work, Courage, Idiot, assert. Compare with a Dictionary.
16. Define quick but similar the Terms: Work, Courage, Idiot, assert. Compare with a Dictionary.

Chapter 2

Views of the World

Narrative

A scientific Endeavor consists of the Study of Events most commonly known as Phenomena. However Science must be precise, the Terms "Event" and "Phenomenon" are actually different Things, that we here need to comprehend.

Another Thing that we need to comprehend is the View of the World. This is how we view the World according to our Biology, Education and Experience. While these are very subjective Issues, I argue that there are three Views of the World that are much more important and less subjective.

2.1 The three views of the World

I have realized that what makes a System an intelligent one is its **Curiosity to understand the World**, and its **Fantasy to mimic it**. This Realization applies to Humans [1] . Humans though, are special Creatures in a Sense that they try to understand the World in usually one of three Views, at least according to [Pohl], whose View I share:

> *Bei der Suche nach Erkenntnis gibt es verschiedene Herangehensweisen: Eine davon ist die Religion, eine andere die Kunst und eine dritte die Wissenschaftt.* **Translation**: by the Search to Knowledge, exists various Approaches: one of them is Religion, another is the Art and a third in the Science [Pohl]

In order to understand these Views (Religion, Art, Science) we need to define various Concepts that are important to our mathematical Endeavor in a sense that they pilot our Attention. Once these Terms are defined I will return to give a clear Definition on the three Views [2] .

Questions

1. What are the three Views of the World after [Pohl]?
2. Which is your favorite View of the World? Every Answer here is correct.

2.1.1 Regarding the View

We have a specific Opinion of how we see the World. A Person with sexual Inclination will see the World according to his sexual Interpretation, while a Person with Inclination to Power will see

[1] as well as Cats!

[2] Obviously these Views are the roughly most common Views that People use. What about viewing the World in Terms of Spaghetti? Expanding on the View of Gödel (incompleteness Theorem) concerning Views, I suspect that there are infinite Views.

the World according to his Interpretation of Power. This Interpretation is roughly called "View" and is based on certain Conditions that a Person imposes for his Interpretation.

Def. 2.1.1.1*:* **View, De. Die Ansicht, Gr. ἡ Θέασις, hee Theasis:** is the Observation of an Area of Interest, whether environmental or notional, under a specific Consideration.

A View however refers also to a personal Observation which can be biased by the Person's Experience or Philosophy. Consequently the Person might require for his View no Proof (when the Person is religious), an Opinion (partial Proof i.e. a subjective View such as in Art) or a full Proof (such as in Science). It is the full Proof, that discriminates the Scientist from the religious Person [3] .

Speaking of View, very often we need to see something differently of what it actually is for simple using it without to go to the Details of it [4] . In other words, we regard something as something different.

Def. 2.1.1.2*:* **Regard as:** to consider something differently of what it is.

E.g. I regard Jim, my Coworker, as a Friend.

Questions

1. What is a View?
2. What means the Expression "Regard as"?
3. The Purpose of this Exercise is to see the Things according to a View that you don't own, i.e. you get fit on the Shoes of another Person. A Comet passes close the Earth and for a few Moments is visible. In 10 Minutes write for each Observer (a Priest, a Scientist, a not educated Citizen) his Interpretation of the Event.

[3] If a religious Person claims Proof of his Religion then he is an Idiot. Even Religion punishes the People that ask and claim a Proof since Religion is based on "blind" Belief. In Christianity, Apostle Thomas denotes this Personality where his Attachment to Proof essentially becomes Belief on its own Right.

[4] This personal View forms the Idea behind Modeling (later) which is to represent something regarded as a combination of simple Things.

2.2 Event and Phenomenon

The Stimulus for the Curiosity to understand the World is provided by Observations of our Environment, whether the Environment is real or mental. These Observations are caused by Events. In other Words, we observe the World by Events that fall to our Perception.

Def. 2.2.0.1*:* **Event De. das Erreignis, τὸ Γεγονός, to Gegonos:** is something that happens and is usually temporary in Nature.

E.g. An Event is such as the Hitting of a Bell of a Clock.

We must understand that an Event is something that attract our Attention according to the current View we hold, otherwise the Event will not taken into Consideration.

Accompanying the "Event" is the Term "Phenomenon".

Def. 2.2.0.2*:* **Phenomenon, De. Phänomen, Gr. τὸ Φαινόμενον, to Phenomenon:** is an Event involving non-frequent or unknown Aspects of Experience [5] .

E.g. A Phenomenon is a Lighting in the Sky.

The Event or the Phenomenon is **provoked by a Cause** and will **exert an Effect**.

Def. 2.2.0.3*:* **Cause, De. Die Ursache, Gr. αἴτιον, τὸ, to Aition:** the Origin of an Event.

[5] Later we will see that there are Laws that connect an Observation to a Phenomenon and a Measurement, such as Faraday's Laws.

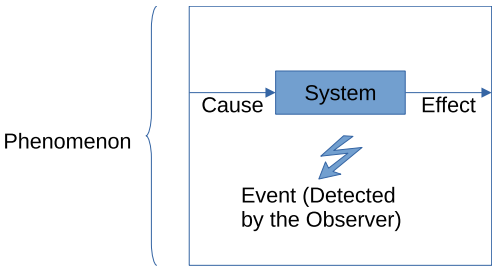


Figure 2.1: Phenomenon and its Composition to Cause, Event, Effect

The Verb for the Noun "Cause" is "cause".

Def. 2.2.0.4*:* **Effect, De. Die Wirkung Gr. τὸ αἰτιατόν, to aitiaton:** is the Result of an Event.

The Verb for the Noun "Effect" is "Affect", but you also might encounter it as "effect".

Typically the people consider the Cause and Effect alone, ignoring the Event. That is acceptable for small Observations where some Aspects are ignored; however in our Case we will keep the Cause-Event-Effect in our Mind during our deeper Endeavors, since it provides a more detailed View of the inner "Mechanics" of Observation [6]

We can consider a Phenomenon to be composed by a Cause, an Event and an Effect. See 2.1 for Phenomenon and its composition to Cause, Event, Effect. No Factor is shown, in Order to keep the Things simple.

Associated with Cause and Effect is the **Property of Causality**. Causality connects the Cause and Effect within the same Context. By Definition:

[6] Speaking on Endeavor, an **Endeavor** is called the Trial (an Attempt) of Undertaking an Activity. An Endeavor may or may not lead to a valid Outcome: what you gain however from any Endeavor is some Experience: Failure is also Part of Development; in fact, intelligent Systems learn from their Failures! Here is a Comment from someone else that I don't remember: an intelligent Person makes Errors, but does not repeat them.

Def. 2.2.0.5*:* **Causality:** is the Property that describes the Relation of Cause and Effect within the same Phenomenon.

The Cause of an Event, can be influenced to a lesser Degree by a secondary Cause. This secondary Cause is called a "Factor".

Def. 2.2.0.6*:* **Factor (Influence), De. der Faktor, Gr. ὁ Παράγων, ho Paragoon:** is an Influence in an Event, typically but *not necessary* embedded to a Cause.

E.g. Crops need good Fields ("Land") and good Weather. A Cause affecting the Quality of Crops is LandQuality. A Factor affecting the Quality of Crops is good Weather.

Remark 2.2.0.1. An Event can be repeated during an Observation, and this gives Rise to the term "Frequency".

Def. 2.2.0.7*:* **EventFrequency AKA Frequency of an Event:** is the Amount of Repetition of an Event in a well defined TimeInterval.

The Definition of Frequency is here slightly loose (what is a "well defined TimeInterval"?). In the Section "Measurement", the Term "Frequency" will be defined appropriately.

Binded with the Term "Frequency" is the Term "Period", which indicates the TimeInterval where the Event occurred.

Def. 2.2.0.8*:* **EventPeriod AKA EventDuration AKA Period of an Event:** is the Amount of Time that an Event occurred.

The definition of Period is here slightly loose since it refers to a **Duration** and not to an Instant of Time. In the section "Measurement", the term will be defined appropriately.

2.2.0.1 FactorTypes

A Phenomenon can be influenced by more than one Factor. If there is more than one Factor then there are three FactorTypes according to their influence:

- **Dominant Factor**: is one that dominates with the Influence.
- **Major Factor**: is one that has a large but not dominant Influence.
- **Minor Factor**: is one that has a small Influence.

Needless to say is that the Examination of a Phenomenon detects each Factor and determines its Type. If something is considered as Factor, then it should be tested for its Contribution to its Phenomenon: if it does not contribute, is not a Factor.

E.g. A Dominant Factor can be considered in a violent Demonstration the Desperation of the Demonstrators, while a Minor Factor can be considered the Alcoholization of the Demonstrators. I.e. The more despaired the Demonstrator, the more violent will turn, while the more alcoholized the more uncontrollable he becomes.

2.2.1 Effect as Phenomenon

Though the Word "Phenomenon" includes the Words "Cause" and "Effect", the Term "Effect" is also used to describe the Result of a Phenomenon in scientific Literature. E.g. Triboelectric Effect (rubbing Amber with Silk for attracting very small Objects) E.g. CrowdEffect (when People in a Crowd form an unconscious but biased Motivation to comply to anything that is imposed to them from an external Factor, i.e. A Politician, an Event etc.).

Questions

1. What is an "Event"?
2. What is a "Phenomenon"?
3. What is a "Cause"?
4. What is a "Effect"?
5. What is a "Factor"?
6. Name the three FactorTypes.
7. What is a "Frequency of an Event"?
8. What is a "Period of an Event"?

Chapter 3

Belief and worldview

Narrative

A religious Person has the View that is considered Truth for him. The Scientist has the View that in Science there is a very limited Appearance of Truth. Here we study the **Belief** and the **Worldview** according to this subtle Aspect.

3.1 Belief and System

Its Time now to make a deeper Look at the Terms **Religion, Art and Science**. Correspondingly these three Terms refer to **BeliefSystems** (associated with Religion), **Subjectivity** (associated with Art) and **Objectivity** (associated with Science).

Before we define these Terms, we need to carefully describe SatelliteTerms that will assist their Definitions. These SatelliteTerms are everywhere in Science.

A **System** is a ComponentsSet that provide something. Formally said:

Def. 3.1.0.1*:* **System, De. Das System, Gr. τὸ σύστημα:** is a set of aggregated Components that cooperatively interact for providing a useful and stable Outcome.

[1]

[1] Compare with: *The word "system", as is the case with most common English words, has a very broad meaning. A frequently used definition of a system is "a set of interrelated components working together toward some common objective"* [Kossiakoff et al]

The Components of the System can also be tangible as well as intangible Items, i.e. Forces. The word "System" comes from the ancient Greek Word "τὸ σύστημα" which describes something stable (it is derived as Word from the Verb " ἵσταμαι", histamai, which means "I stand", i.e. "I am stable".).

The Components within a System interact. The Term "Interaction" means:

Def. 3.1.0.2*:* **Interaction:** is the Event where two or more Items act and react between them.

Knowing about Systems and Interactions, we can now define the Word "Belief". A Belief is just an unchecked Information about something. Formally said:

Def. 3.1.0.3*:* **Belief:** is called the Acceptance of an Understanding as a Fact.

E.g. Say that someone speaks about a Subject. If you cannot understand the Subject, then is impossible to build a Set of Definitions for the Subject. If you understand the Subject, then you can build its Definitions and you can accept it or reject it based on your Opinion. If you accept the Subject without any Proof of it, then you have a Belief on the Subject.

People build Systems that encompass their Beliefs in order to understand the World. Formally Said, a BeliefSystem is:

Def. 3.1.0.4*:* **BeliefSystem:** this is a Set of Beliefs, that are usually codependent in

Order for the System they represent to be stable.

E.g. The BeliefSystem of a Sadist, concerns all these related Concepts (HumanBehavior, Pain, Suffering, Torture) that are codependent on his Worldview, to explain his Beliefs.

E.g. The BeliefSystem of a Cleric concerns all these related Concepts (God, Society, Ethics, Principles) that are codependent on his Worldview, to explain his Beliefs.

The later Quote, I found in Hippocratic Corpus.

Δύο γὰρ, ἐπιστήμη τε καὶ δόξα, ὧν τὸ μὲν ἐπίστασθαι ποιέει, τὸ δὲ ἀγνοεῖν

Two different things are science and belief: the one brings knowledge, the other ignorance.

3.1.1 Scientific Religion is Religion

Here I must to cover the particular Concept of **scientific Religion** as well as its Representatives. There is no Definition about this Aspect which became apparent during the so called "Corona"-Pandemic, where Corporations asked the People not to ask Questions concerning their sold Medication. When Scientist ask the Public not to ask about their Science, then we are dealing with Religion, and in this Case with a Religion that is supported by scientific Claims! I call "scientific Religion" any Belief that is supported by Scientists without to provide any Proof and concurrently to be unquestionable on scientific Inquiry. By Definition:

Def. 3.1.1.1*:* **Scientific religion, De. Die Wissenschaftliche Religion Gr. ἡ ἐπιστημονικὴ Θρησκεία, hee epistimonikee threskeia:** is the Belief that Science can answer everything in the Sense and as such Science is unquestionable.

Considering the Word "unquestionable", this I define as:

Def. 3.1.1.2*:* **Unquestionable, De. fraglos, Gr. ἀναμφισβήτητον:** without Doubt

Scientific Religion is used in Rhetoric and Marketing to sell Products beyond a Doubt of their Efficacy which is of Course a Lie: no Product can be 100% efficient or having all its Requirements fulfilled! Consequently this Sale of Science is a Religion based on a very limited Amount of scientific Facts. Exists Organizations that preach openly or partially *the use of Science and Reason as parts of their BeliefSystems*; these Organizations are *Abrahamic* [2] and typical Representatives (among others) are **Christiansects** (open Organizations) and **Masonries** (semi-open or closed Organization to the Public). I cannot stress more, that their BeliefSystem is Religious in Nature, and while can be supported by Science and Reason, *however in a very limited Fashion*, it is only to keep its Members (AKA useful Idiots) in place. Except of them, there is the Caste of Atheist these Days, that their BeliefSystem, surpasses the Ethics of Science itself: these are the most dangerous of all, since they assume the Position of the external Observer to the HumanSociety while they are Part of the HumanSociety. [3] [4]

[2] "Abrahamic" means it derives from a Dude called "Abraham" that created the Judaism; from Judaism came Christianity and Islam. I don't have much Problems with Beliefs, but the Problem (which still persist these Days) with the Abrahamic View is that it Blocks even any scholar Investigation. This means that the "End"-Product cannot be controlled.

[3] A typical example of them are the Proponents of Transhumanity as well as others most seen in black Projects (morphogenetic Field Manipulation, genetic Intolerance Schemes etc.) that cooperate with the Elites of the Planet for the Control of the Population; in a more scientific World, this Caste, will be treated accordingly as Terrorists.

[4] The Scientist is also Ethicist, because Ethics is part of Philosophy and Philosophy is Part of Science. The Scientist is not a Moralist though, since Morality is a Part of a cultural Framework of social Conduct and not the scientific Framework of social Conduct.

Questions

1. What is "System"?
2. What is "Interaction"?
3. What is "Belief"?
4. What is "BeliefSystem"?
5. What is "Scientific Religion"?
6. What means that something is "unquestionable"?

3.2 Definitions of three Worldviews

A WorldView is how you see the World according to your mental Processes you use to think. By Definition:

Def. 3.2.0.1*:* **Worldview, De. Die Weltanschauung, Gr. ἡ Κοσμοθέασις, hee Cosmotheasis:** is a BeliefSystem that tries to explain Life in general under the HumanReasoning.

A Worldview can be religious, artistic or scientific. A Synonym for Worldview is **personal Philosophy** [5] .

An individual can have a Mix of the three Worldviews in the three Worldviews are defined as follows:

Def. 3.2.0.2*:* **Religion, De. Die Religion, Gr. ἡ Θρησκεία, hee Threeskeia:** is a subjective proofless BeliefSystem intended to explain the Unknown.

Def. 3.2.0.3*:* **Art:** is an emotional Activity or emotional Expression that produces tangible or intangible Artifacts of aesthetic Value.

[5] There can be actually a a personal Philosophy and a common Philosophy. Typically most of the People have a common Philosophy colored by their shared Beliefs.

[6]

It is worth to note that Aristotle defined Art as the *Mimic of Nature*. With this Definition in Mind, we can distinguish real Art from Garbage.

Def. 3.2.0.4*:* **Science, De. Die Wissenschaft, Gr. ἡ Ἐπιστήμη, hee Episteemee:** is the systematic Study of Behavior of the physical World as well as of the Applications of physical Phenomena.

Though the physical World can be considered only what the Nature creates, since the Human belongs to Nature, then his Activities are considered Part of the physical World. The Consequence of this View, is sometimes erroneously taken, that some HumanActivities are deprecated and consequently do not belong to Science! This is of Course wrong, since Science records and tries to explain the Phenomena within the physical World, no matter if the Phenomena are against a religious or moral System. However, there are Activities, that can be studied scientifically, but are used malevolent against the People or the Environment. The Science of Politics, was created precisely for providing Solutions to these Problems, and together with the Science of Philosophy can decide what is allowed or not to be studied.

Questions

1. What is "Worldview"?
2. What is "Religion"?
3. What is "Art"?
4. What is "Science"?

3.3 Classes of Science

Science is divided into four Groups called Classes of Science. These are:

[6] However **Art** is also called a higher SkillLevel demanded by an Activity or Task, e.g. He used his Art to solve the Problem. We will meet soon this Term in the Definition of Mathematics.

- Formal Sciences
- Physical Sciences
- Life Sciences
- Social Sciences

Some Sciences for each ScienceClass is now reported. As we forward to their Field as remote it becomes the Verification of their Subject of Study, with the Social Sciences the greatest Offender. See their Remark.

Questions

1. State the four Classes of Science.

3.4 Scientific Disciplines

A **Discipline** is called a StudyArea. Concerning Science, a "Discipline" might Concern a particular Science, or a Part of a Science.

A **SubjectDiscipline** is any Science specific to a particular Subject, such as Medicine, Mathematics, Chemistry etc. Typically when you attend an Effort for a BachelorDegree in a Science, you study a SubjectDiscipline.

Each Science that is developed is further divided into Parts. A **scientific Discipline** is a separate Part of a particular Science that contains a very specific View of the particular Science, such as the Discipline of Plastic Surgery in the Science of Medicine. When you attend an Effort for a College- or minor Degree, you study a scientific Discipline with some Elements of the SubjectDiscipline. While minor Degrees can teach you a scientific Discipline, some scientific Disciplines are only attainable when you have already obtained a SubjectDegree, that is, you cannot obtain the scientific Discipline of plastic Surgery without having already the Certification of a the SubjectDiscipline of Medicine. The Terms are defined as:

Def. 3.4.0.1*:* **Discipline (Science):** is called a StudyArea

Def. 3.4.0.2*:* **SubjectDiscipline (Science):** is called any Science specific to a particular Subject.

Def. 3.4.0.3*:* **Scientific Discipline (Science):** is called any separate Part of a particular Science that contains a very specific View and Endeavor of the particular Science

Sometimes a Discipline can be called a "Field" of a specified Science.

E.g. The Field of Mathematics, the Field of Electricity called "Electronics".

Questions

1. What is Discipline? Give an Example.
2. What is SubjectDiscipline? Give an Example.
3. What is scientific Discipline? Give an Example.

3.4.1 Formal Sciences

Formal Sciences [7] are the those that are concerned with the systematic Use of Reasoning and the scientific Method as Tools of scientific Discovery, Analysis and Development. As Sciences, these are the last Line of Defense against Belief. Examples of these Sciences are:

- Mathematics
- Logic
- Systems
- Informatics

[7] These used to belong to physical Sciences. Advancements in Mathematics, MachineComputation and SystemAnalysis raised the need for pure Verification and in Essence created a Branch of Science surrounded by extreme Purity of Methods and Views.

Questions

1. What are formal Sciences? Give an Example.

3.4.2 Physical Sciences

Physical Sciences are those concerned with Discovery of the physical World by Use of Formal Sciences. Examples of these Sciences are:

- Chemistry
- Geology
- EarthSciences
- Physics

Questions

1. What are physical Sciences? Give an Example.

3.4.3 LifeSciences

Life Sciences are those concerned with the Study of Life and the associated Manifestations of Life as well as the Control of Life. They mainly use as Tools the Formal as well Physical Sciences. Examples of these Sciences are:

- Biology
- Agriculture
- Ecology
- Medicine

Questions

1. What are LifeSciences? Give an Example.

3.4.4 Social Sciences

Social Sciences are those concerned with the Study of HumanLife as a System of Behaviors as well as the Control of HumanLife. They mainly use as Tools the Formal , Life- and as well as physical Sciences. Examples of these Sciences are:

- Linguistics
- Sociology
- Psychology
- Economy
- Law

3.4.4.1 Problems in social Sciences

There are some Problems in social Sciences that hunt the associated Scientists. Social Sciences are very close to HumanRelations and Politics. For these Proximities they are highly biased towards their Findings, with Sociology the greatest Offender of all. Things eventually will change, but until then here what you need to know:

- Most Sociologists avoid Mathematics because they have a BeliefSystem that does not allow them to get Proofs against it. Change is coming but will be very remote. Most of them cannot and don't want to study Probabilities and Statistics.
- Most of Scientific Developments in Social Sciences are based on personal Theories and personal Interpretations. This is no Science, but Religion.
- The personal political Preferences in Social Sciences are not subjected to critical Thinking among the "social Studies"-Scientists. They see what they want to see and that's it. In Addition they will not read any Texts of opposing Views since they believe that the Texts hold zero Credibility and Reliability.

- Corporations, Governments, and religious Groups do not want to change the social Studies because they have a political Agenda that serves them well.
- You are considered a Traitor if you challenge the official View of Social Sciences. *The Sheep should be under Control.*

Questions

1. What are SocialSciences? Give an Example.

3.5 Bibliography

• `[Kossiakoff et al]`: Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer. Systems Engineering Principles and Practice. Wiley, USA, 2003, second Edition.

Chapter 4

Objective and Subjective View

Narrative

When we observe a Phenomenon, we need to consider it from various Perspectives that we named "Views". We can use only one View for the Phenomenon as far as this View is trivial. For complex Phenomena we must use many Views.

Consider an Accident involving more than two Participants and more than one Observer. An Investigator will have to question all Participants and Observers to understand what happened in the Accident. Consequently an Investigator needs many Views.

4.1 Observation

When we embark to scientific Research we study our Subject by Observation in Order to understand the Phenomenon as well as the Factors affecting the Phenomenon.

Def. 4.1.0.1*:* **Observation:** is the Act of carefully seeing an Event or an Environment of Interest.

Observation is always done with a Purpose in Mind; in this Regard, the Opposite of Observation is "Seeing".

Def. 4.1.0.2*:* **Seeing:** is the act of using Vision without any Purpose.

E.g. Seeing the Mountains. Seeing the Sky.

As a Scientist you will need to have two Observations, one based on Reality and another based on Scenarios that you consider. In Essence you need more than one View.

Def. 4.1.0.3*:* **Mental Observation:** is the mental Activity of considering the Phenomenon from various Views that are not directly Observable.

E.g. The Consideration of having a Bar near the Ocean as your own Company, brings to the Mind the mental Observations of:

1. Fantasizing how the People interact with the Bar
2. Calculating how much Profits and Losses the Bar will create
3. Calculating how much Problem can cause during a Crisis such as when the People drink too much and cause Problems.
4. Calculating the environmental Impact of the Bar to the Beach and the Sea, due to the Patrons.

While the Fantasy about the Interaction of People and Bar is an Observation that can be easily verified by the Reality, the Calculation of Profit and Problems is a mental Observation that will consider Items that are normally transparent to the Customers of the Bar.

Questions

1. What is “Observation”?
2. What is “Seeing”?
3. What is “What is “mental Observation”?
4. A patient is operated to remove his Cancer. What are some Aspects of his Disease that his Doctor mentally observe? Answer in maximum of 5 minutes, this is a free thinking exercise [1]

4.2 Objectivity and Science

Science is based on Facts and various Views on these Facts. To separate Facts from Fallacies we need to examine our Views towards the right Use of our Understanding.

Def. 4.2.0.1*:* **Subjectivity:** is the mental Observation based on Beliefs, Emotions and limited or no Facts.

Despite its Reputation, Subjectivity is common in Science. E.g. If you have worked 18 Years to prove something and someone comes to you with the opposite Opinion which is correct, it is possible to apply Subjectivity to your Research in Order to persuade the People (AKA Lambs) that your Results are true! Of course this is not Science; it is *Marketing*.

Def. 4.2.0.2*:* **Objectivity:** is the mental Observation based on Facts.

Objectivity is the Target of the Scientist's Endeavor to create correct and verifiable Results. Because the Amount of Views that the Scientist must hold for his Research is forbiddingly high, the Objectivity is chosen on very limited Phenomena and Factors affecting the Phenomena.

We can now define two fundamental Designations for Nouns (these Designations are grammatically speaking “Adjectives”), that play a special Role to the scientific Endeavor. These Designations concern how we view the Things, from many Views or only one View.

Def. 4.2.0.3*:* **subjective:** an Observation or Research is subjective when it is based on Belief or Emotion instead of Fact.

The NounEquivalent of the Word “subjective” is Subjectivity.

The Scientists seeks the Truth based on Proofs. The Beliefs or Emotions of the Scientist are not Proofs. Thus every Datum that contains Belief or Emotion is considered subjective and cannot be taken as true.

However, the subjective Aspects of Research can be taken into Account as Indications for a real Phenomenon, if they correlate to the Phenomenon. E.g. A supernatural Event if recorded, should be correlated with the religious Worldview in order to gain BehaviorPatterns, that might be explained; saying that, you shouldn't lose much Time researching religious Beliefs unless you study Religion from the Ethnology- and MythologyPerspective.

Def. 4.2.0.4*:* **objective:** an Observation or Research is objective when it is based on Fact and not Belief or Emotion.

The NounEquivalent of the word “objective” is “Objectivity”.

Science must be objective in order to deliver Knowledge based on Truth. Objectivity is achieved by Proofs which are based on Data. Consequently Data can generate Theories, and Theories can generate Experiments, new Data and new Proofs, in an endless Cycle of Research (and Tears!). However there are Limits to this Process based on non-scientific Politics: the non-scientific Politics are based on BeliefSystems that have strong Roots to the emotional Part of the Humans and obviously affect Scientists (which according to Legend are human too!). The only Cure of producing Objectivity in your Work is to have open Mind for the Change,

[1] Note that an Idea here is that the Cancer causes SideEffects to the Patient.

which is inevitable. As is frequently said, *in Science we don't bet that our Work will be always valid.*

Questions

1. What is "Subjectivity"?
2. What is "Objectivity"?
3. What is "subjective"?
4. What is "objective"?

Chapter 5

Knowledge

Narrative

Here we study the Knowledge and its Aspects such as Facts and Data.

5.1 The Parts of Knowledge

The Search for Knowledge is an Issue to all the three Worldviews. As I found out by my personal Quest, in Science Knowledge is acquired, in Art is worked, and in Religion is *revealed* [1] . I will be concerned here with the Issue of Knowledge in Science.

As every serious Work, Science is created by the careful Examination of the World; this Examination of the World is called "Study".

Def. 5.1.0.1*:* **Study, De. Das Studium, ἡ σπουδή, he spoude:** is the careful Examination of an Area of Interest.

The Study has the Purpose to acquire Knowledge, and if possible Wisdom.

Remark 5.1.0.1. To study quickly Wisdom read Proverbs [2] from a Dictionary and try to map them in your Experience. Once Done on a Proverb, try to defeat the Proverb by finding a Scenario of the same Experience that the Proverb does not work. E.g. The Road to Hell is full of good Intentions. This Proverb describes that from good Intentions you can end up in Hell (e.g. getting Married). However, there are many good Intentions that end up in Paradise [3] , or at least to the Perception of Paradise if any.

A very common Word encountered in a Study is "Information".

Def. 5.1.0.3*:* **Information, De. Die Information, ἡ πληροφορία, he pleeroforia:** is called a Set of correlated Facts and Data.

Remark 5.1.0.2. Facts and Data are correlated themselves if they belong to the same Context. Mathematically I perceive them as Data being Numbers and Facts being Functions operating on Data.

In Knowledge is very important the Understanding of the Area of Study for any Information gathered. This Area is called "Context". I formally define it as:

[1] Concerning Religion, this means that if you own Charisma, you can use it to get a good Standard of Living by Preaching to People what they want to hear. This is the Opposite to ancient preabrahamic Religions that mostly promoted and protected Science as Part of the Pantheistic View. The Pantheistic View considers that everything is holy and holds a God or its a View of God. This is much more positive than be a *Doulos of God*, i.e. a Slave of God as Abrahamic Religions teach.

[2] *Def.* 5.1.0.2*:* **Proverb:** is a Sentence that describes a Pattern of Experience that applies to a wide Context if and only if the Context displays frequently this Pattern of Experience.

[3] The Term "Paradise" here is an Allusion to an idealized Condition with no Flaws.

Def. 5.1.0.4*:* **Context:** The surrounding Space of Meaning.

The Definition implies that Information, i.e. *Meaning*, is surrounded by a Space where other Data reside and give to the Meaning a Support. E.g. The Word "Execution" has different Context in a ProgrammingLanguage and another Context in PoliceService.

Information is a part of Knowledge and as such consists of primary and secondary Understandings of a InterestSubject.

It is now Time to define Knowledge:

Def. 5.1.0.5*:* **Knowledge, De. Die Kenntnis, ἡ γνῶσις, he gnoosis:** is the primary Understanding of a Subject of Interest

Knowledge is composed of Informations, Information is extracted from DataProcessing, Data are acquired by Facts or Processes. See Diagram for the KnowledgeAcquisition based on Process 5.1 as well as Diagram 5.2 for the KnowledgeComposition. Take some Time to study them.

Some Explanations here are needed.

Typically **Knowledge** is the Requirement the Scientist has to solve. Knowledge encompasses one or more Information and Data. The **continuous Experience of Knowledge** gives to the Scientist **Wisdom**. Wisdom is the critical Use of Knowledge based on Experience. You acquire Wisdom only with complete Dedication to the Context; there is no WisdomBook available here, only yourself [4]

Def. 5.1.0.6*:* **Wisdom, De. Die Weissheit, Gr. ἡ Σοφία, hee Sophia:** is the Capacity to optimally perform Thinking and Action based on past Experience and Knowledge.

I covered here the Part of knowledge and now *a personal Contribution*, though I am pretty sure am the last Person on

[4] Here the Proverb "The Truth is inside you"is very real. Actually I complement the Sentence with the Sentence "now go and fuck yourself/get the fuck out" to describe the Loneliness of Attaining the Wisdom; **none will help you**.

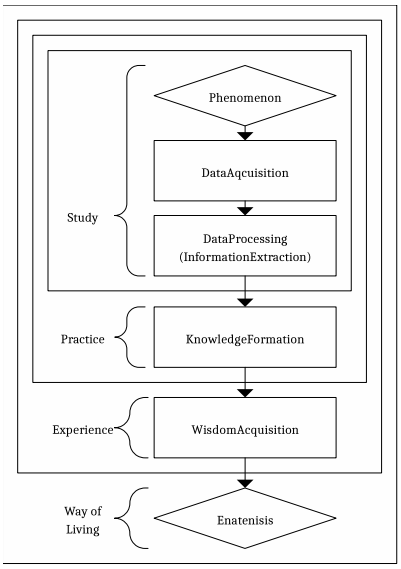


Figure 5.1: KnowledgeAcquisition as a Process. Note that each Part of an Acquisition is termed as a Process itself, while ProcessesGroups and individual Processes are Part of Activities (Study, Practice, Experience and Way of Living). The Arrows represent the DataFlow, while I marked Phenomenon and Enatenisis as a Source and Destination of Data, while using the Rhombus as Symbol (In FlowChart this Symbol is for Decision not Termination).

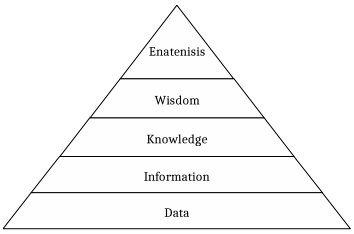


Figure 5.2: Knowledge as a Pyramid, where Enatenisis is the highest Level of Knowledge, while at the lowest Level of the Pyramid reside the Data.

the Earth that spoke about (I haven't checked it). I call "Enatenisis" the maximum Level of KnowledgeAcquisition that a Person can acquire and this Level corresponds to experiencing Knowledge as you live it.

Def. 5.1.0.7*:* **Enatenisis, Gr. ἐνατένισις:** is the intellectual Maximum of KnowledgeAcquisition and describes the Living of Knowledge itself.

Enatenisis as Word (ἐνατένισις) stems from a Book for Proclus, a Greek Philosopher during the Times of cultural Decay of the Roman Imperium, where Philosophy was turning into a religious Duty [5] . Enatenisis means the "gazing intensively" and as a Word became to me Synonymous for **intellectual Ecstasy**, the Feeling of not only have Wisdom, but being able to reveal to yourself all the Knowledge and Action you need. I have put the Word here, instead of absolute Knowledge or **Gnosis** (Γνῶσις, a Greek word meaning "Knowledge" but also used by secretive Organizations as *absolute Knowledge* (which the Morons don't have). Since I have a Form of Synesthesia, I had the experience in the Past (concerning some Issues of scientific Development that I discovered under severe Distress) of Gazing in full Knowledge of my Discoveries. Later, I found out that I was not the only one. There are other People around with this Experience, especially in Parts of Life where intense Creativity is required (though not in modern Arts, unfortunately). The scientific Term of Enatenisis I claim that is **ecstatic Epilepsy**, where is studied by the Discipline of Neurology. Consequently I claim to this Paragraph that Enatenisis is the highest Level of KnowledgeAqcquisition, encompassing even Wisdom. I also claim that exists an extremely small Amount of HumanPopulation that lives *continuously* on the state of Enatenisis and are at the Peak of what the Maxim of Heraclitus refers: *Gods are immortal Men, Men are mortal Gods* [6] .

Concerning the Figure 5.2, the Pyramid shows that at the HierarchyTop, the Enatenisis is the maximum Achievement on Knowledge. Concerning the Figure 5.1, here is a Process where there is no back Reference to the Steps and thus this Process is idealized. Typically there is a back Reference to the "Study"-Subprocess (not shown), a back Reference to the "Study"- and "Practice"-Subprocess (not shown) where the "Practice"-Subprocess looks itself and the "Study"-Subprocess. The same goes for the "Experience"- and "Way of Living"-Subprocess. See Diagram 5.3. In my Experience, Enatenisis is the only Step that does not require back Reference, and this is my Claim.

Questions

1. What is "Study"?
2. What is "Proverb"?
3. What is "Information"?
4. What is "Knowledge"?
5. What is "Wisdom"?
6. What is "Enatenisis"?
7. Write on Paper a Moment of Enatenisis if you ever had. Search your Memories for Moments of extreme Distress

[5] Proclus lived in Times of religious Decadence, where the ancient Religions were replaced by eastern Influences with no cultural or academic Education. Imagine as today it happens in the third World Countries, where Preachers perform "self-invented"-Rituals and have fanatic Followers (and everyone carries Technologies that were derived from Science!) with no critical Thinking even in their moral Aspect. More perverse than that cannot be.

[6] Historically in my Opinion the Enatenisis was achieved only by Alexander, Napoleon, Hitler in the Fields of Strategy and Politics, Plato and Buddha in the Field of Philosophy, Sun Tzu and Clausewitz in the Field of WarScience, Aristotle, Da Vinci, Gauss, Poincaré in the Sciences, Shakespeare (AKA Sir Francis Bacon) Jung and Campbell in the Field of Psychology.

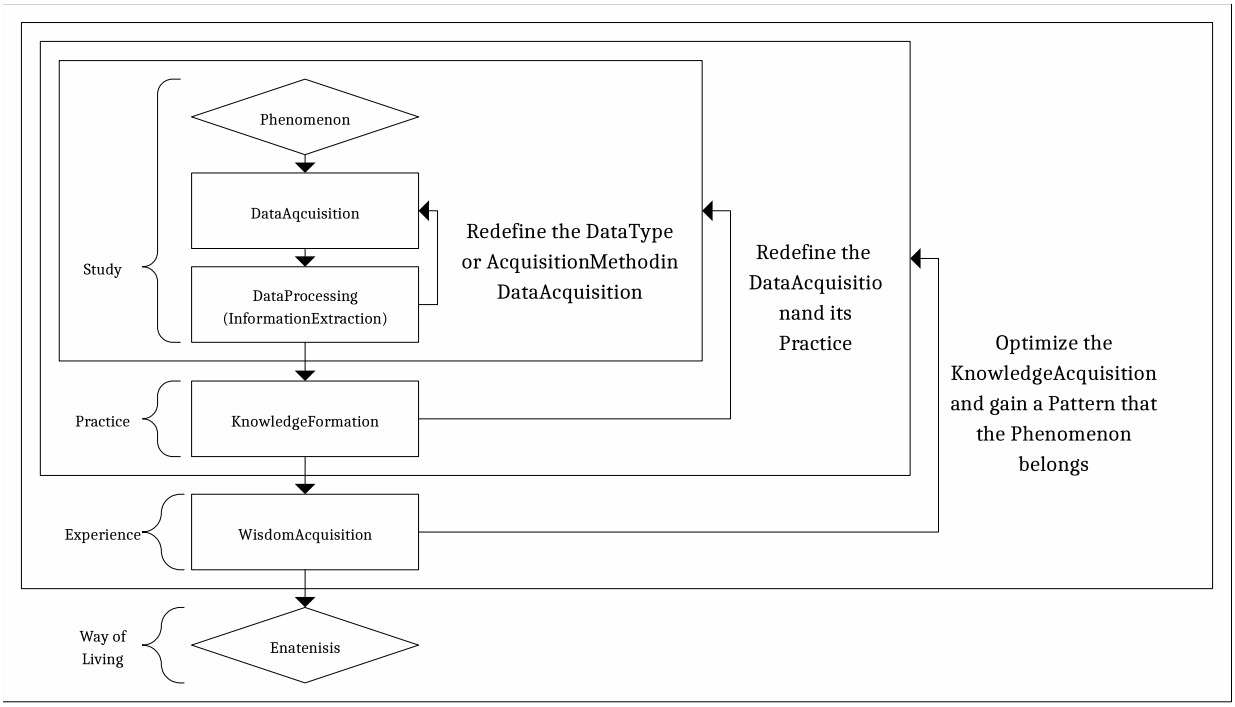


Figure 5.3: Knowledge as a Pyramid, where Enatenisis is the highest Level of Knowledge. Here the back References (AKA Feedback) correspond to an Iteration to each Step, so that the Analysis, Methods and Results are refined.

where you did have creative Inspiration. Now get the fuck out of here.

5.2 Data

In our so called "digital Age", the Word "Data" has become the *Holy Grail* [7] for the Discovery of Information by Science. Here I focus on the actual Item, the Datum, which is the smallest InformationUnit.

Def. 5.2.0.1*:* **Datum (pl. Data):** is the minimum InformationUnit.

The Datum is the lowest Level of Information and is created from Facts (DataAcquisition) or from Processes (DataProcessing).

A Datum as Information can be stored in any InformationStorageEquipment such a Paper or Computer, to name a few.

The Datum can be composed from many Data, but typically the word "Data" is used for any *Collection of Information.*

Closely related to Data are the DataGenerators called "Facts" as Sources of Truth.

Def. 5.2.0.2*:* **Fact (Element of Truth):** is called an Element of Truth within a Phenomenon.

A Fact is something that we accept (not regard! [8]) as true.

E.g. If we see a Demonstration of Citizens turning to a violent Event, is safe to take as a Fact that within the Demonstration there was one criminal Element.

A Fact is proven or we have sufficient Information to indicate this. E.g. A Fact is Jesus. There were at least 6 Jesii (AKA Christii) in the historic Past, and all of them tried to become religious Leaders of their People. At least one of them asserted (or his Followers said) that he was the Son of the God (of his Religion). The Proofs for their existence are historical Sources, and not the religious BookCollection under the Name "New Testament". A Fact is Reality, not the accompanying Legend [9] .

In real Life what we consider as a Fact diverges from Truth when it is involved in Politics and historical Science. The Belief of one Person is the Fact of another Person and vice versa. True historical and political Facts which resonate into political Life are typically StateSecret and researched by the same Forces that declared them as Beliefs. This is the reason why a Historian is very careful to his Research. By my Experience, in our Days, the Historian does not work with the Authorities, but merely collaborates, in Order to gain Access to Information; what he will display is the StateNarrative.

Another topic about the Datum is the **Metadatum**

Def. 5.2.0.3*:* **Metadatum:** this a Datum used to describe Data.

E.g the Metadatum "Day" describes the seven Days of the Week, namely Monday to Sunday. Consequently the Metadatum is used to signify Data themselves.

The Concept of Metadatum acquired Impetus with the Advancement of digital Technologies, where Information itself

[7] "Holy Grail" refers to the Allusion of a Cup holding the Blood of Jesus the so called "Initiated" (Christus, χρησμένος, χρηστός), where its Quest was assigned to the Knights of the Round Table, within the Arthurian Myths. The Allusion refers to the ultimate Quest for the greatest Treasure.

[8] An Axiom is something that we regard as true.

[9] By the Way, 360 Years before the Jesii, the Subjects of Philosophy and axiomatic Logic were available; however whenever you see Religion to come *after* Science, consider that there is Decadence in the Society under Scrutiny. The Jesii are a Proof of this Decadence, since they indicate that there was no educational System in Place, i.e. within their Vicinity. Note: People are naturally biased to the Holy and sometimes Religion can help this; My Position on Christianity is negative and I regard Christianity as the primary Source of this Decadence. Saying that, Christians are responsible for the most Tolerance and Creation of Wealth on this Planet. Removing them, will kill the global financial System, even in "non Christian"-Countries.

needs to be identified by Use of Descriptors called “Tags”. Tags help to describe various Aspects of the Data such as their Origin, Date of Creation, Date of Modification, Tools used, original StorageLocation, current StorageLocation to mention a few.

In official Documentation, it can be considered a Metadatum, the Name of the Editor of the Document. In this way, the circulated Document can either enclose or hide the Name of the Editor in order to add Credibility or hide his Identity.

Questions

1. What is “Datum”?
2. What is “Fact”?
3. How “Fact” and “Belief” compare?
4. What is “Metadatum”?

Chapter 6

Processes of Knowledge

Narrative

The Acquisition of Knowledge passes through Generators of Knowledge which itself are mental Processes that the Scientist create in his (sick) Mind. Here we define these Processes and the Element that consist these Processes.

6.1 The Processes of Knowledge

The Acquisition of Knowledge is derived from mental Processes that are affected by (among others) the scientific Background of the Scientist. What defines a Scientist is his prudent Use of his Thinking. In this Regard, Prudence can also attribute a scientific Background to a Person that assumes the *Role of the Scientist*. This Prudence is Part of the Type of Thinking called "Consideration".

Def. 6.1.0.1*:* **Consideration:** is the Act of thinking prudently

For those who don't understand the Word "Prudence" here is my Definition:

Def. 6.1.0.2*:* **Prudence (Philosophy):** is the Virtue of being reasonable towards your Thinking and the Actions you take.

Prudence was considered by ancient Greeks as the Principle Virtue where all the other Virtues stem [1]

In addition a Scientist applies Consideration in a more balanced Manner than a non-Scientist, by applying a mental Process.

Def. 6.1.0.3*:* **Mental Process:** is the the Consideration of a Phenomenon in a stepwise Manner similar to a Process.

While a mental Process is affected by many Aspects of "Human"-Experience, in Science is also affected by the Constraints of the scientific Method; these Constraints are the primary Factors (Influences) of the mental Process.

A Scientist can employ many mental Processes, but the main three Processes he uses are **Abstraction**, **Generalization**, and **Specialization**.

Typically a Scientist creates a Model of his Phenomenon using the least Details and then generalizes the Model to similar Phenomena as well as specializes the Model to fit as much as possible Data. This Work is can only be described as the Balancing on a Rope (the Abstraction), and holding a Pole where in one Side is the Generalization and on the other Side the Specialization. Under the Rope is the Sea of Reality consisting of Sharks (real Scientists) as well Fishes looking as Sharks (wannabe Scientists but mostly Idiots. The latter you are free to liquidate

[1] By the Way the ancient Greeks had the three Principal Virtues: Prudence, Courage, Freedom, which is a Philosophy on Life that I fully support. If you have these these Virtues you don't need any other Book; *you become the Book*.

without Loss of your Humanity). By Definition, Abstraction, Generalization and Specialization are:

Def. 6.1.0.4*:* **Abstraction:** is the mental Process where a Model around the Subject of Endeavor is build based to the fewest Information that adds Value to the Model.

E.g. A Model of a Vehicle, might contain Information about Reliability, Agility, FuelConsumption, while the Information about its Color is left Outside of its Modeling. The fewer Information restricts the Model in its View, but adds Simplicity to the Investigation of the Model. Therefore we can further reiterate: **An Abstraction is a Generalization used to build a Model as an Approximation of the Reality, and using only the necessary Properties available.**

Def. 6.1.0.5*:* **Generalization:** is the Process of deriving Information by the Observation of a small DataSet.

Generalization is a "double Edge"-Sword: it can be used to make valid but also invalid Assumptions. Typically, Generalization is used for a first Estimate of a Situation, where there are not much Data available. Later, the Generalization can be accepted or aborted due to supporting or unsupporting Data.

E.g. We can observe in a City many CarAccidents and generalize that the People driving Cars in this City are Idiots. Keeping this Generalization in Mind, a careful Examination can reveal that there is no enforcement of proper DrivingBehaviour by the Authorities, leading to excessive CarAccidents. Generalization might reveal a Pattern of Behavior (e.g. the People causing the CarAccidents have *Attention Deficit Disorder* or *mental Disturbance*) but you need to look further in order to find out and record the Causes and Influences.

Def. 6.1.0.6*:* **Specialization:** is the Process of deriving Information by the Observation of a very small Area of Endeavor, that has a large DataSet.

Specialization as a Term, is not used frequently in this Context, but rather in the Sense of acquiring Knowledge in a very specific Domain.

Some Issues concerning the Acquisition of Knowledge is the Course of Activities leading into Knowledge. Because the Acquisition displays an Amount of Data, Decisions need to be made of what these Data represent. A formal Decision is called in Science a **Judgment**. To apply Judgment you need **Reason**, which is the Ability to apply Judgment based only on Facts. The Process of Reason is called **Reasoning**.

Def. 6.1.0.7*:* **Judgment:** is the Ability to decide.

Notice that Judgment here infers Decisions based on good or ill, not on personal Morals.

Def. 6.1.0.8*:* **Reason:** is the Ability to decide based on Facts.

Def. 6.1.0.9*:* **Reasoning:** is the Process of Reason

Questions

1. What is "Generalization"?
2. What is "Specialization"?
3. What is "Abstraction"?
4. What is "Judgment"?
5. What is "Reason"?
6. What is "Reasoning"?

Chapter 7

SystemElements

7.1 Narrative

A vital Part in the KnowledgeAcquisition is the functional Decomposition of Information to its Constituents and then the Recomposition of Information to Elements that show clearly the inner Workings of Information. By regarding the Subject of Interest as a System we can derive its Parts, their Relations and Interactions. Here I touch the Subject of the SystemElements themselves regarding SystemsTheory. In this Respect, I give a Preview to Systems that later can integrate to various Views.

Remark 7.1.0.1. A System can be tangible (made with physical or SoftwareComponents) or intangible (narrated in a Text but not physically present or even a Body of Regulations that someone must follow).

E.g. (tangible System): A CarEngine is physical System made of mechanical Components, a ComputerProgram is made of SoftwareComponents that reside in a ComputerFile.

E.g (intangible System): A System of Belief in Elfs [1] , the System of international Units of Measurement, the System of Regulations within a University, the System of Law.

A personal Note on Systems: I study Systems as Part of electrical Engineering (BEng) and Mechatronics (MSc) Curriculum. In particular on Mechatronics, I did Study physical Systems as well as Vibration Control. I am not a Physicist or "theoretical Informatics"-Scientist, and the current View of Systems is my personal one; every Divergence [2] from the official Views is due to me and only to me.

7.2 SystemElements

Previously we defined a System as as *a set of aggregated Components that cooperatively interact for providing a useful and stable Outcome.* The **Purpose** of a System is to fulfill a Need. E.g. The television System is a Collection of Components that are interdependent and cooperating to fulfill the Need of receiving Video- and AudioCommunication. The Term "Purpose" is defined as:

Def. 7.2.0.1*:* **Purpose, De. Der Zweck, Gr. ὁ Σκοπός, ho Skopos:** is called the Aim AKA Intention of a Design or Act.

Since the word "System" stems etymologically from the Greek verb "histamai" ἵσταμαι which means "I stand", in the Sense of **Stability**, Stability should be considered as the main Property of any System. Indeed, this Stability is attained by employing a **Structure** that binds the Parts of the System together. Defining the Term "Structure" regarding a System I give the following Definition:

[1] Hail Dark Elf!

[2] Blasphemy! Send him to the Pyre!

Def. 7.2.0.2*:* **Structure, De. Die Struktur, ἡ δομή, hee domee:** is the assigned Arrangement of the SystemParts that provide Purpose, Cohesion and Stability to the System.

There are many different Types of Structure for the same Needs, with some Systems having a minimal or unique Structure while other have a multitude of different Structures available for Implementation with only one realized for each instance.

As an Example, look at the Type of Buildings and their Purpose: You have LibraryBuildings, Offices, CommunityBuildings, Residences which by the way of Purpose have different Functionality.

Remark 7.2.0.1. The more complicated a System is, the more different Structures can represent the System, in other Words, the Complexity of a System drives different Interpretations of the System, all driven to optimize a certain Aspect of the System.

E.g. A Motel is a Hotel optimized to serve Travelers with a Vehicle on a Highway.

The Components of a System are the individual Parts that cooperate and interconnect within the Structure in order to implement the System.

Def. 7.2.0.3*:* **Component, De. Der Teil, Der Anteil, Die Komponente, Das Element, τὸ ἐξάρτημα, τὸ συστατικόν, to exarteema, to systatikon:** is called a Constituent of a System.

The Etymology of Component is from the Latin Verb *Com+Ponere*, i.e. to place together [3] . The Component on its own Merit has a discrete (i.e. separate) Structure or a conceived Existence that is assumed as discrete, i.e. its an Individuum.

[3] In ancient Greek, the Etymology of Component refers to the Part of the System, τὸ συστατικόν while the newer Term τὸ ἐξάρτημα refers to the something hanged up.

Components are organized into **Modules**. Modules provide the functional Aspects of a System by organizing the ComponentAggregation into a Group that perform a meaningful Task. A Component can be a Module on its own right.

Def. 7.2.0.4*:* **SystemElement AKA Module:** is one or more Components that provide a named Functionality to the System

Typically the SystemElement is robust, interchangeable and self-contained while it provides only one Function (i.e. Behavior). A SystemElement with more than one Functions is called "Subsystem".

In Engineering mostly the Term "Module" is used, while the term SystemElement might be used for a Subsystem.

Another Aspect of the System is the Connections of each Component or Module to other Parts of the System.

Def. 7.2.0.5*:* **Connection:** is a Relation between Participants.

The Connection can be used for Energy or InformationExchange as well as Influence to the ComponentBehaviour. The Latter is considered more as hidden Cause as well as parasitic in Nature than useful Effect.

Finally the Concept of Subsystem is very important in complex Systems. A Subsystem contains Components and SystemElements that provide a critical Functionality to the System. This Functionality is made of smaller Functions that are provided by the Components and SystemElements.

Def. 7.2.0.6*:* **Subsystem:** is any Part of a System having a unique and complex Functionality that is driven by the Purpose of the System.

An interesting View of a System is as a Process that takes and gives Items. In this Sense the Term "Processor" is more appropriate but not necessary; there exists also Systems that do not take or give

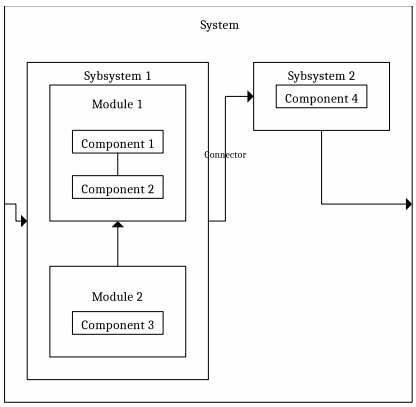


Figure 7.1: A Decomposition of a System to its Blocks.

anything. However, the View of the System as Processor is important since it can give particular Aspects of the System concerning its Composition and Purpose.

In the Figure next, a System, its Components, its Modules, Connections and Subsystems are described in a typical Notation, 7.1.

Questions

1. What is "System"?
2. What is "Purpose"?
3. What is "Structure"?
4. What is "Component"?
5. What is "Module"?
6. What is "Connection"?
7. What is "Subsystem"?

7.3 Properties of SystemElements

If we take a SystemElement and we try to analyze it we will find that contains a certain Feature that is usable. This Feature is called "Quality".

Def. 7.3.0.1*:* **Quality, De. Die Qualität, Gr. τὸ προσόν, to proson:** is the Feature that something exhibits.

E.g. **the Quality of Color**. The Color that an Object exhibits is a Feature that we can sense and use.

Note that "Quality" can also be used to denote a Feature of a better Standard (i.e. a better Performance).

E.g. This T-Shirt is of better Quality than the other T-Shirt.

The Quality as a ComparisonFigure is avoided in the mathematical Context, since it refers to a Collection of Features that need to be compared, not to a single Feature comparing itself. A Collection of Features is best modeled as a Collection of Qualities and this is Subject of Aggregation of Qualities (later).

Most often, for the scientific Exploration the Term "Property" is used. It is defined as:

Def. 7.3.0.2*:* **Property, De. Die Eigenschaft, ἡ ἰδιότης, hee idiotees:** is called any usable Quality.

In Mathematics a Property is discovered by use of **scientific Method** (this detects its Existence) and **Proof** (this verifies its Existence).

E.g. The **Property of Smell**, the **Property of electric Conductivity of Metals**, the **Property of GenderAttraction**, the **Property of Corruption as exhibiting the Pattern of DiseaseTransmition among HumansGroup**, the **Property of Color**.

Properties are used for Mapping the real World to the scientific World, which is done by documenting them and analysing them. Properties are detected by using Observation, Experiment, DataAnalysis, while their Proof is done by experimental as well as mathematical Verification.

It is worth mentioning that a Property is an abstract Concept, not an Object per se: you will never find a representative Object with the name Property, but only *an Object containing the Property.* E.g. You will

never find the Property Color, but the Realization "red". However, you can describe a Property and obviously model it.

In my Opinion, the most common Property is the **ExistenceProperty**, where something exists or it doesn't.

E.g. There is a Man on the Street. E.g. There is no Man on the Street.

An Issue of Property is the Amount of how much the Property demonstrates itself. This is answered by the Term "Quantity".

Def. 7.3.0.3*:* **Quantity AKA Value AKA Magnitude, De. Die Quantität, Der Wert, ἡ ποσότης, hee posotees:** is the Amount of something.

The Quantity of something answers the Question "how many".

E.g. A Quantity of 5 oranges (How many oranges?).

The Quantity is a Property on its own Merit. If a Phenomenon cannot be measured, then we cannot speak of Quantity.

Having a Property and a Quantity of it, we must ask if the Property is inherent to a SystemElement or the SystemElement is capable on itself to exhibit this Property. E.g. Having the Requirement to push a Nail in a Wood, we can use a Hammer which has the inherent Property of pushing the Nail. However, a Stone is also capable for this Task, though is not designed for it. This Inheritance of Property is described as "Ability":

Def. 7.3.0.4*:* **Ability, De. Das Vermögen, Gr. ἡ ἱκανότης, hee ikanotees:** is the owned Competence

In English, the Etymology stems from the same Latin Word "habilis" which stems from the Verb "habeo" which measn "to have". Source: [Wedgwood].

The Situation where something is capable to do something is called Capability:

Def. 7.3.0.5*:* **Capability, De. Die Fähigkeit, Gr. ἡ δυνατότης, hee dunatotees:** is the hold Competence, the Competence that something does not own, but is able to exhibit.

In English the Etymology stems from the same Latin Word "capabilis" which stems from the Verb "capere" which means "to hold" as well "to contain". Source: [Skeat].

Needless to say, Education can make you capable but you must to work hard to become able if you are not born with it. E.g. A Professional *is able* to solve Problems while a non-Professional *is capable* to solve Problems but he also might not.

Competence is defined as:

Def. 7.3.0.6*:* **Competence, De. Die Befähigung, Gr, Προσόν, τὸ, to Proson:** is the Qualification for a given Task.

E.g. This Person is qualified for the Position of Secretary since he has the Competence (i.e. the Qualification) for this.

Having spoken of Property, an associated Term is **Attribute**. An Attribute is something attached to something else, so that it gives to it a particular Characteristic.

Def. 7.3.0.7*:* **Attribute:** is a Quality or Characteristic attached to something.

The Term "Attribute" derives from the Latin Verb "attribuere" which means "assign". "Attribute" as a Word is somewhat mixed or even abused by its Users who sometimes identify it with Property. "Property" is innate, while "Attribute" is attached.

Something funny: The Term "Idiot", as demonstrated linguistically in the Greek Name for "Property", stems from the Word "ἰδιότης" as a Person that takes care only himself, i.e. a selfish Person. This is because the Humans are social Animals and consequently a selfish Person in ancient Greece was not a considered someone serious. See a somewhat different Interpretation in [Skeat].

Questions

1. What is “Quality”?
2. What is Property?
3. What is “Quantity”?
4. What is “Ability”?
5. What is “Capability”?
6. What is “Competence”?
7. What is “Attribute”?
8. The Sentence, “He was natural born Professional”, does it refer to an Ability or Capability?
9. The Sentence “Jim works as a Policeman. On his free time he can cook” , does it refer to an Ability or Capability for the Cooking?
10. Search in a Medium (Internet, Books, a FamilyMember or a Friend), for Properties.

Chapter 8

System and its ExchangeElements

Narrative

A System does not have only Parts but has Items that serve as Exchange for the Operations performed within the System. In Addition, there is a Boundary that separates the System from its Environment.

The Purpose of this Chapter is to enhance the View of the System as Part of an Environment where the System operates. This View is important because the Environment provides the Context and the consequently the Purpose of the System.

8.1 ExchangeElements

The System is Part of an Environment where the Environment is defined as everything outside the System.

Def. 8.1.0.1*:* **Environment AKA Surrounding AKA Stage AKA Framework AKA OperationsTheater De. Die Umgebung, Die Umwelt, τὸ περιβάλλον, to perivallon:** is the Area outside a System and encloses the System.

The Environment can provide the System with Signals as well as Matter and Energy. The System can also provide the same Items to the Environment. Here the Terms "Signal", "Matter" and "Energy" should be taken generally instead of specific in Order to map them to the Endeavor of your Understanding.

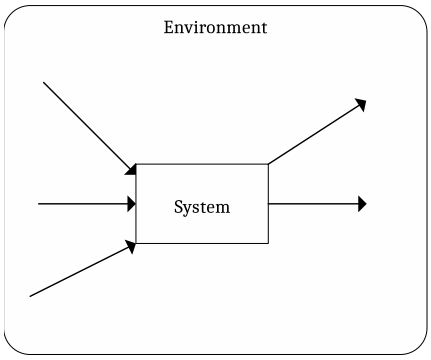


Figure 8.1: The Environment encloses the System and interchanges Information, Energy and Matter with the System.

Remark 8.1.0.1. When reading about Environment you might encounter it with different Names, as shown in the Definition (the List is not exhaustive). Try to retain the Context of your Endeavor and use if possible the Terms of the Professionals.

The Environment and System is shown in the Figure 8.1

Generally I refer to the Signals, Matter and Energy as "ExchangeElements". This is a Claim by myself since in ControlEngineering the Nomenclature considers these Items as separate Entities, as far I know.

Def. 8.1.0.2*:* **ExchangeElement, De. Das Vermittlungselement, τὸ στοιχεῖον συναλλαγῆς, to stoicheion sunallages:** is a Signal, Energy or Matter that is used in the Exchange

between a System and an Environment.

Information is Exchanged by Use of **Signals**. These are Variations that affect Participants in InformationExchange by varying a physical Property in such a Way that it will represent an Information. The Variation is made possible by Use of Coding (later on that) from the Side of the InformationGenerator.

E.g. A Variation in electric Voltage causes a Sound in a Loudspeaker.

The Signal is defined as:

Def. 8.1.0.3*:* **Signal:** is a Variation that conveys Information and acts like an InformationCarrier.
[1]

A Signal is used to transfer Information within the System (between the Components, SystemElements and Subsystems) as well as to supply the System with Information.

In Nature, a System is supplied **Energy** in order to do something. You can consider Energy as an Item that you can exchange such as Money. In Systems, I consider Energy as a Property that allows me to do something; if I don't have this Property, I cannot do something.

Def. 8.1.0.4*:* **Energy:** is the Property that allows Work to be done.

Frequntly the Term **"Work"** appears in Physics: this is simple the Energy required to physically displace an Object. Keeping up with the physical View of the World, the Term "Work" is defined as:

Def. 8.1.0.5*:* **Work:** is the Property that expends Energy in order to do something.

"Work" as Term used to mean Energy but somewhat fall from the Physics from this View. Still, Generations and Generations of Physicists and Engineers use it. My Personal Definition is as a Property that uses another Property called "Energy".

A subtle Detail is that a Signal in some Cases is an EnergyVariation, e.g. a Signal based on the Variation of electric Voltage. This Detail concerns the Distinction of Responsibilities between Energy and Signal in a System and these Responsibilities can become almost indistinguishable; this is an Issue to be considered in the "Complex Systems"-Analysis. In short, consider that a Signal can be used as Information as well as Energy, depending on the Context at Hand.

Associated with Energy is **"Matter"**, as the Interaction, of both of them, participates in all physical Processes. Matter is simple any Substance that we can use and physically is tangible.

Def. 8.1.0.6*:* **Matter, De. Die Materie, Gr. ἡ ὑλη, hee oule:** is the perceptible physical Substance that occupies Space.
[2]

To recapitulate, a System is Part of an Environment which can exchange with it Signals, Matter and Energy. Signal is the Carrier of Information, Matter is something tangible that can be used based on Instructions taken from Information and Energy is something that can be used to make the System work.

Questions

1. What is "Environment"?
2. What is "ExchangeElement"?
3. What is "Signal"?
4. What is "Energy"?
5. What is "Work"?
6. What is "Matter"?

[1] This Definition is based on Cooke et al Electronics Dictionary. Since the Variation can also be with Respect to any other Sequence, then the Variation is beyond the Concept of Time, i.e. the Variation can be Spatial or any other Variation with Respect to another Variable.

[2] This Definition was based on [Webster New modern English Dictionary.]

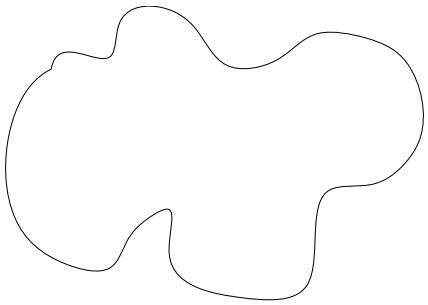


Figure 8.2: The Boundary encloses the internal Constituents of a System.

8.2 SystemBoundary

A System obviously is Part of something greater than itself. A Question that arises is where are located the **Boundaries of the System**; such a Question will reveal the Interaction of the System to its Environment in Terms of ExchangeElements.

A **SystemBoundary** is an Enclosure that accommodates the System. It serves as an Isolation of the System from external Influences that might affect the System in its Operation. In Addition it defines the Location of the System regarding its Environment. The Term "Boundary" is defined as a Separation that surrounds something.

Def. 8.2.0.1*:* **Boundary, De. Die Grenze, Gr. τὸ ὅριον, to horion:** is the Limit that encloses something.

A Boundary can be depicted as a closed Line that encloses and defines an Area.8.2.

Since in SystemsTheory we can work with various Types of Systems, the Idea of Boundary is beyond the physical Concept of a Wall.

E.g. A political PropagandaSystem [3] has its bounds everywhere except to Places where is considered "Taboo", i.e. you cannot propagate Communism in a Church, a Christianity cannot be propagated to a communist Location. Of course these Bounds are more or less physical Limitations. What about intangible Limitations such the Boundary of Context? Speaking on Communism in a Shop that tries to sell you Buttons, is an "out of Context"-Endeavor that defines the Limit of the Systems Bound.

Remark 8.2.0.1. The Context is the Boundary of an intangible System.

When we speak about Systems, we speak about the **SystemBoundary**. The SystemBoundary is regarded always in Terms of the System it models.

Def. 8.2.0.2*:* **SystemBoundary, De. Die Systemgrenze, τὸ ὅριον συστήματος, to horion systematos:** is the Limit that encloses a System.

Questions

1. What is "Boundary"?
2. What is "SystemBoundary"?

8.3 SystemIsolation and ExchangeElements

Having defined the SystemBoundary, it is time to define the three Types of Systems that a Scientist might Encounter concerning the SystemBehavior and the ExchangeElements:

- Isolated System
- Closed System
- Open System

While there are two Concepts (Energy, Matter) that physically concern a System, I have also included Information. This has

[3] By the way, the Name "Propaganda" means precisely that: Propagation (of Ideas or Information or Misinformation). **Something funny**: In Order for the Allies to give Credibility to their "Propaganda", they abolished the Term and gave it a new Name called "Information"; this is how you can lie and get away with it. *This is the Way©.*

Consequences in theoretical Physics and Informatics that I will not mention, since it is a large Subject. Consequently I based my Definitions on enlarging the current Definitions. A Definition of all Systems [4] is now due:

Def. 8.3.0.1*:* **Isolated System, De. Das isolierte System, Gr. τὸ ἀπομονωμένον σύστημα, to apomonomenon systeema:** is the one that does not exchange anything from its Environment.

A Consequence of such a System is that it maintains the Information, Energy and Matter within it for its Use, something that is very important in Physics and Informatics. However such a System is what the Eye of the Beholder [5] will define based on his Assumptions.

E.g. The Universe is considered an isolated System that every Exchange of Information, Matter and Energy occurs within itself. Such a System we simple don't know if exists, but at least for the Universe that we are living, no Violation of this Maintenance of Energy and Matter have been *critically* observed [6] , though for its InformationContent there are no Metrics available [7] to make any Reference to Conservation of Information as an equivalent Property.

Remark 8.3.0.1. For the Purpose of Modeling we can assume that an isolated System either does exists or is sufficiently isolated from its Environment such as there is practically no Influence from the Environment to the System.

Def. 8.3.0.2*:* **Closed System, De. Das geschlossene System, Gr. τὸ κλειστον σύστημα, to kleiston systeema:** is the one that Exchanges only Energy and Information from its Environment.
[8]

Such a System is typically an "InformationProcessing"-System that can use EnergyVariation as means of InformationTransfer by use of Signals.

Def. 8.3.0.3*:* **Open System, De. Das geöffnete System, Gr. τὸ ἀνοικτον σύστημα, to anoikton systeema:** is the one that exchanges Information, Energy and Matter from its Environment.

Such a System is everything that a Person can define a SystemBoundary and ExchangeElements. E.g. An "AirDefense"-Weapon (i.e. an Aircraft (this includes the Pilot and his Aircraft)) takes Commands (Information), Fuel (Energy) and Ammunition (Matter) from its CommandCenter and produces *spare Parts* (i.e obliterates EnemyAircrafts.) ("The Event of Obliteration of the Enemy Aircraft"=Information, "Explosion of EnemyAircraft"=Energy, "Fragments of the EnemyAircraft"=Matter) [9] .

An Open System is not necessary visible from the Outside concerning its Operations. Visibility of a System is another Aspect that I raise later.

Following a Revision of Terms, the SystemBoundary defines the Limits of the System and there are three types of Systems according to the Exchange of Infor-

[4] These Definitions I wrote them based on Information from [Stöcker] (its English Counterpart is [Benenson]), as well as others, see Bibliography.

[5] This linguistic Expression means what the Person has a certain Opinion of what he sees which is very personal, i.e. subjective Opinion.

[6] Actually there are many observed but there is no sufficient Funding, Cooperation and moral Support for further Investigation. Perhaps because new Technologies can give Freedom to People, something that the current political Climate tries to avoid for its own Agenda, that is, your Slavery.

[7] I suspect the Metrics concern the Speculation of the Morphogenetic Fields as an InformationContainer.

[8] Sometimes the Terms "isolated"- and "closed"-System are Synonymous; please refer in this Case to the Context of the Subject.

[9] Here I use the Humor of Lockheed Corporation that advertised itself in an Exhibition as "the largest Producer of spare Parts worldwide". The Example that I provide is very roughly said. In your InterestField, the Model you provide will be much more complex.

mation, Energy and Matter.

Questions

1. What is “Isolated System”?
2. What is “Closed System”?
3. What is “Open System”?

Chapter 9

System and Administration

Narrative

The Administration of a System is directly dependent on its NetworkTopology as well as its Configuration. You cannot simple put SystemElements and wait to see the System to work. Here I examine the Administration as well as the NetworkTopologies that make the System to bind itself and fulfill its Purpose.

9.1 SystemAdministration

SystemElements have different Roles to play in a System. It is possible for the same SystemElement to have more than one Instance to a System for the Purpose of implementing a different Role according to its Ability or Capability. A Role is a Responsibility that someone takes according to a Scenario.

Def. 9.1.0.1*:* **Role:** is called a Responsibility assumed by a Participant in an Interaction.

The Responsibility of a Role can be his Ability (something inherent in the Participant) or his Capability (something which the Participant can accomplish). Obviously an Ability is better than a Capability for the Reason of attaining the most Needs required.

The Role occurs in a Scenario. The Scenario sets the Plan where the Interaction of the Role and the Event takes place.

Def. 9.1.0.2*:* **Scenario:** is called a Plan for the Participants, the Events and the Interactions between them.

E.g. "Tom worked under adverse Condition", means that the Participant "Tom" interacted ("worked") under the Event of "adverse Condition".

A SystemElement can also be called a Participant to the System, though the Term "Participant" can include Energy and Information as Roles.

Def. 9.1.0.3*:* **Participant:** is any Part of the System that participates to the System and can be Energy, Information, Subsystem, Module or Component.
[1]

The SystemElements are associated within a Spectrum of the Extremes of Hierarchy and Equality as means of Administration. Administration is simple the Management of the System itself. This Management can be embedded in the System as the Function of the System itself or a SystemElement optimizes the other SystemElements for a particular Task.

Def. 9.1.0.4*:* **Administration:** is the Management of SystemElements allowing the optimum Performance for the System.

Examples of Administration is the Ad-

[1] In this Definition I used the Term "Information" instead of Signal in Order to highlight Information as Part of the System and not Signal per se. I keep this due to my own View concerning my current Research on Morphogenetic Fields.

ministration Office of a Hotel, where the HotelManager commands the Personnel of the Hotel to various Tasks.

Remark 9.1.0.1. Administration concerns the Actions within the System.

In the Administration the Use of Responsibilities arranges a particular Configuration of the SystemMembers according to:

- Priorities of Tasks
- Properties of each SystemElement (as well as its Abilities and Capabilities)
- Importance of each SystemElement

This particular Configuration is called "**Hierarchy**".

Def. 9.1.0.5*:* **Hierarchy:** is called an Arrangement of Responsibilities according to the Importance of the Participants to the System

Typically the highest Responsibility is assigned to the leading Participant, while the lowest Responsibilities are assigned or shared to lower level Participants.

In the opposing Side of Hierarchy exists also an Arrangement of Responsibilities where each SystemElement is *regarded as* equal. This Arrangement is called Holoarchy.

Def. 9.1.0.6*:* **Holoarchy:** is called the Arrangement of Responsibilities according to Equality of Properties.

Holoarchy is a new Concept that is not really verified in actual Systems. It is given as an IdeaGenerator for mostly arranging the lower Level SystemParts. In Reality, even the most Equity- and EqualitySystems are hierarchical, because Responsibility must always be traced to the SystemElement that controls a Purpose or a Property in the System [2] .

[2] In the Domain of Politics even **Anarchism** is hierarchical, but only to the Level of CommunityCouncils which are small Groups of People that hold the Responsibility of CommunityOrder; there is no central Authority for controlling the CommunityCouncils (no Ἀρχή, i.e. no (principal) Authority). If there is no CommunityCouncil there is another political Situation, called "**Anarchy**" where the Chaos prevails due to Conflicts of Interests from the Participants. This view of Anarchism is pretty different from a violent Demonstration ("Anarchy") which is usually organized by suspicious "HumanRights"-Organizations and uses as useful Idiots the young Persons. **This is a Warning: "HumanRights"-Organizations don't have Interests on Individuals except of their Sacrifice for the Objectives of the "HumanRights"-Organization.**

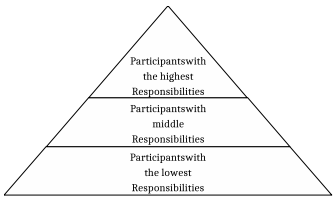


Figure 9.1: The Symbol of Hierarchy is typically a Pyramid. Within the Pyramid are the Participants.

The Symbol for Hierarchy is recognized to be a Pyramid with the Base holding Participants of the lowest Responsibilities and the Top holding Participants of the highest Responsibilities. See Figure 9.1. The Pyramid, at the Top contains less Persons than at the Bottom.

Questions

1. What is "Role"?
2. What is "Participant"?
3. What is "Administration"?
4. What is "Hierarchy"?
5. What is "Holoarchy"?

9.2 SystemLayers

Typically a System will eventually either change or optimized as the Time goes by,

in Order to become fully functional so that it can cope to the Requirements imposed from its Environment; this is called "Adaptation" for "change" and "Optimization" for "optimized" (become better).

Adaptation is the Process where the RequirementsChange are apparent through Time and Measures have to be taken for maintaining the SystemPerformance. By Definition:

Def. 9.2.0.1*:* **Adaptation:** is called the Process of Changing the Functionality for Responding to different environmental Requirements.

E.g. As the Day gives its Way to the Night, the Temperature gradually falls. A Person makes Fire in order to get warm as the Requirement for Heat arises.

Optimization is the Process where the Requirements are fixed through Time and Measures have to be taken for increasing the SystemPerformance. By Definition:

Def. 9.2.0.2*:* **Optimization:** is the act of reaching the Optimum of a something.

Together with the Term "Optimization", comes the Word "Optimum", which refers to the best Outcome of a Situation or an Item that fits perfectly to its Function. By Definition:

Def. 9.2.0.3*:* **Optimum, De. Das Optimum, Gr. τὸ βέλτιστον, to beltiston:** is considered the best Solution to a Demand, in Accordance to the Concordance of the SystemComponents between them.

Adaptation will typically add new Functionalities and remove existing Functionalities for assisting the Integration of the System to its new Environment. While Optimization might use the same Strategy, practically it will tightly integrate its SystemElements to achieve the best possible SystemPurpose. Ideally, the Parts of the System are well integrated so that we cannot distinguish their individual Function. This consequently imposes the following Problem: how do you separate the Functionality of the SystemElements so that you gain access to the System without disturbing the Optimization?

A Solution to this Problem is to design or analyze the System from the Beginning by viewing it as different Layers of Subsystems servicing different Needs. The Layers concern different Aspects of the Systems and can even converge in some Points.

This View at the first Time seems as a Reiteration of the Subsystem by Use of renaming it to something else! This is though not the Case: a SystemLayer is a View of a common Property that might be shared by one, few or all Components and SystemElements.

Def. 9.2.0.4*:* **SystemLayer:** is a View of the System in Terms of an Aspect that is possible that is shared even by all SystemElements.

E.g. A Car is a System made from many Components, SystemElements and Subsystems. We can define it in Terms of SystemLayers as a Layer of Parts that share electric Energy, Layer of Parts made from Metals, Layer of Parts that communicate Signals etc. Some Layers might converge to a SystemElement responsible for two Layers, e.g. an electric Motor can be considered on the mechanical Layer, on the "electric Power"-Layer or even on the "environmental Impact"-Layer.

Saying that, is possible and sometimes necessary to describe a Subsystem alone as a Layer. However, a Layer does not necessary serve the Description of a Subsystem: it describes everything in common. See Figure 9.2 for the Description of possible Layers in a Car.

Remark 9.2.0.1. A special Reasoning behind the View of the Layer is to examine the Crossing of Boundaries between Subsystems.

E.g. During the Crossreference of JobApplicants, the "HumanResources"-

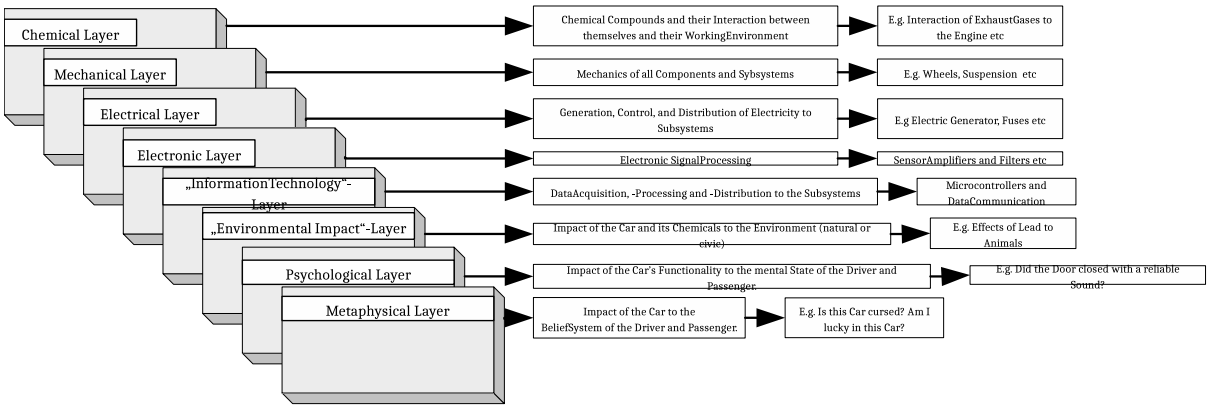

Chemical Layer
Mechanical Layer
Electrical Layer
Electronic Layer
„Information Technology"-Layer
„Environmental Impact"-Layer
Psychological Layer
Metaphysical Layer
Chemical Compounds and their Interaction between themselves and their WorkingEnvironment
E.g. Interaction of ExhaustGases to the Engine etc
Mechanics of all Components and Sybsystems
E.g. Wheels, Suspension etc
Generation, Control, and Distribution of Electricity to Subsystems
E.g Electric Generator, Fuses etc
Electronic SignalProcessing
SensorAmplifiers and Filters etc
DataAcquisition, -Processing and -Distribution to the Subsystems
Microcontrollers and DataCommunication
Impact of the Car and its Chemicals to the Environment (natural or civic)
E.g. Effects of Lead to Animals
Impact of the Car's Functionality to the mental State of the Driver and Passenger.
E.g. Did the Door closed with a reliable Sound?
Impact of the Car to the BeliefSystem of the Driver and Passenger.
E.g. Is this Car cursed? Am I lucky in this Car?

Figure 9.2: This is an incomplete Set of SystemLayers for a Car.

Managers will check not only the JobQualifications but also the criminal Record, in Order to avoid the Placement of a Candidate to a critical Position such like a BankTeller. Thus the "Layer of Job" and the "Layer of Credibility" are compared so that no Component with lower Credibility can pass to the Layer of Job with high Credibility.

Questions

1. What is "Adaptation"?
2. What is "Optimization"?
3. What is "Optimum"?
4. What is "SystemLayer"?

9.3 SystemNetwork

The Communication, EnergyDistribution and MatterTransport in a System is carried by another System called "Network". While a Signal is considered the Carrier of Information, the Network concerns the physical Interpretation for SignalCarrier but also carries the Tasks mentioned for Energy and Matter. The Network has three Parts:

- The Node
- The Link
- The NetworkTopology

The Node is the NetworkPart that can represent a SystemElement. The Link is the Channel that distributes ExchangeElements. The NetworkTopology arranges the PlacementcConfiguration of the Nodes and Links for the PurposeOptimization of the System . Having said that, the Definitions of all of these are:

Def. 9.3.0.1*:* **Node:** is a AccessPoint for Processing an Item.

This AccessPoint can be regarded as a Processor for the ExchangeElement. It might be denoted in a Diagram as a Circle. It represents a Component or Subsystem.

Def. 9.3.0.2*:* **Link:** is the Channel of transporting an Item.

The Channel can be considered as a Way, Cable, or Path that an ExchangeElement can cross. It is denoted in a Diagram as a Line.

Def. 9.3.0.3*:* **Network, De. Das Netz, Das Netzwerk, Gr. τὸ δίκτυον, to diktuon:** is a System of connected Nodes by Use of Links in a certain NetworkTopology.

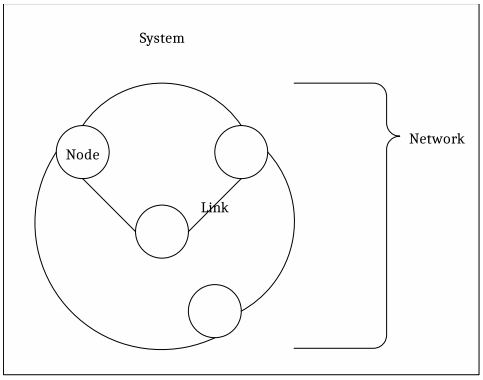


Figure 9.3: This trivial Network is provided as Concept only.

See Figure 9.3 for the typical Notation. A Node is typically a Circle, a Link can be an Arc or a straight Line. The Network is connects the SystemParts.

Concerning the Term "Topology", this refers to the Configuration of the Connections between Nodes. By Definition:

Def. 9.3.0.4*:* **NetworkTopology AKA Topology De. Netztopologie, Gr. ἡ τοπολογία δικτύου, hee topologia diktuou:** is the ConnectionConfiguration of Nodes and Links within a Network.

Concerning a System, the NetworkTopology is called SystemTopology, though most of the Times is also called NetworkTopology, and is concerned with the optimum Operation of the System.

Def. 9.3.0.5*:* **SystemTopology AKA NetworkTopology De. Die SystemTopologie Gr. ἡ τοπολογία συστήματος, hee topologia systematos:** is called the Configuration of Nodes and Links into an optimum Transportation- and DistributionMechanism.

Examples of Examples of SystemTopology are the Line, Ring and Star NetworkTopologies. Each Topology has its Merits and Misses. There are three Types of NetworkTopologies, the Star, the Bus and the Ring. See Figure 9.4 for the three Types and an Example of a mixed Topology in

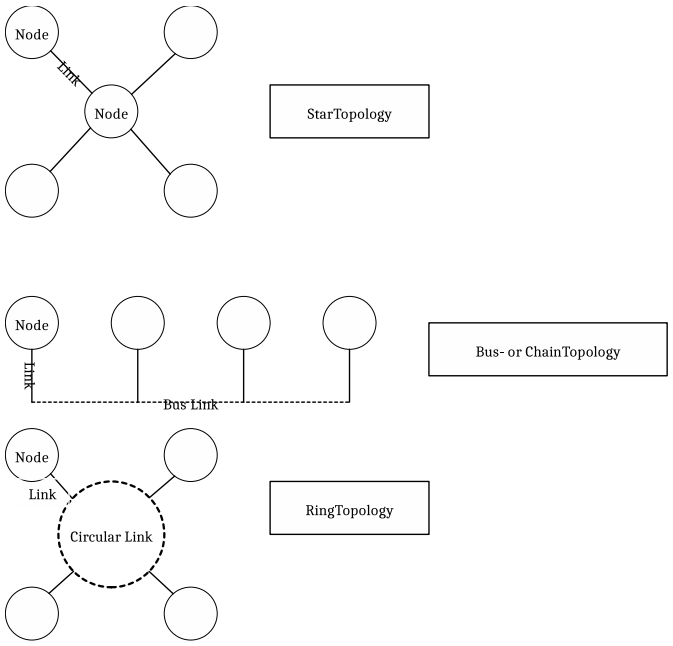


Figure 9.4: The three basic NetworkTopologies.

9.5.

Remark 9.3.0.1. A Word of Caution between Topology and Configuration: while in a Conversation both might refer to a Configuration, these Terms are not equal! Topology refers to the Configuration of the Connections while Configuration refers to the Placement of Nodes as well as the Configuration of Connections. I personally discriminate them as Topology=Connections, Configuration=Placements.

Components and SystemElements are connected within the System for CooperationReasons as well as Interactions. Connection refers to the Ability to relate to a Participant while Connectivity refers to the Manner and Amount of Connections between a Participant and the Rest of Participants. Giving to these Terms the necessary Focus:

Def. 9.3.0.6*:* **Connectivity:** is called the Manner and Amount of Connections that

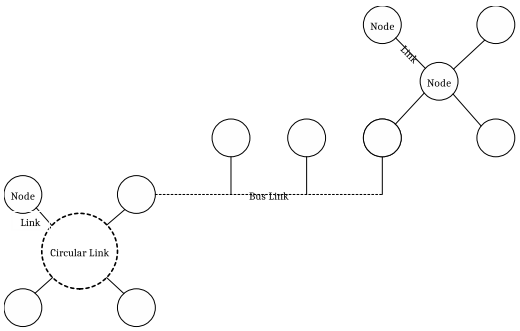


Figure 9.5: This trivial Network is an Example of mixing the three basic NetworkTopologies. It is provided as Concept only.

a Participant holds regarding his Relation to the other Participants.

The Connectivity concerns the Type of ExchangeElement as well as the Amount of Connection to the other Nodes in a Network. A particular Issue with a Network is being able to connect with the outside World. This is done via a Port, which is an AccessPoint. By Definition:

Def. 9.3.0.7*:* **Port:** is an Interface between a System and its Environment serving as an AccessPoint to the System.

Closely associated with the Port is the Term "Interface". An Interface is a ConnectionMechanism between a Port and a Link. This is defined as:

Def. 9.3.0.8*:* **Interface (Systems):** is a ConnectionMechanism between two Systems.

Questions

1. What is "Node"?
2. What is "Link"?
3. What is "Network"?
4. What is "NetworkTopology"?
5. What is "SystemTopology"?
6. Give the three Types of SystemTopology.
7. What is "Connectivity"?
8. What is "Port"?
9. What is "Interface"?

9.4 Structuring the SystemElements

Having some Ideas about the System I can now define some Elements of the System that provide the Structuring itself irrespective of the HierarchyStructure adopted.

9.4.1 Pattern

Whatever Structure is adopted in a System, as a Structure will follow a Pattern. Strictly speaking a Pattern is a Description of how the Things are arranged irrespective of the Context. E.g. the AnimalBehavior called "Lie" is related to the Concealment also called "Camouflage", i.e. it follows the same *Pattern*.

Def. 9.4.1.1*:* **Pattern, De. Der Muster, Gr. τὸ μοτίβο, ἡ μορφοσυστοιχία , to motivo, hee morphosystoichia:** is a temporal and/or spatial Description that follows specific Rules of Deployment.

The most simple Patterns follow a Repetition of Occurence of their Context.

E.g. A temporal Pattern is the Repetition of historical Events.

E.g. A temporal Pattern is a periodic Signal.

E.g. A spatial Pattern is the Repetition of Forms on a Fabric

However Patterns are more than that since are usually encountered as ContextSystems of their own Right by displaying a complex Structure that can be used repeatedly across many Domains.

E.g. A spatial Pattern is Hierarchy (as the Concept itself) since it can be used for the Administration as well as Arrangement of SystemParts according only to their Functionality. For political Systems this means that Hierarchy can exist in vastly different Systems as Nazism and Anarchy: in the former, the Context of Hierarchy is Leadership and Functionality, while in the latter their is Equality and Functionality (at the Level of Aggregation of the CommunityCouncils, because the CommunityCouncils can have any other political System possible).

E.g. A temporal Pattern is the Sequence "**Problem, Reaction, Solution**" which was researched and examined by **Journalist David Icke** as a Pattern of PopulationControl. This Pattern is found in many historical Events where a Controller creates intentionally a Problem, instigates a Reaction and then provides a Solution according to his own strategic Goals. The Reasoning behind the Deployment of this Pattern is to conceal the Controller from the public View or even endow the Controller with moral Ground [3] A common Name for this Pattern in late 20th Century is "**False Flag Operation**" but this must to be seen as the complete **"Problem, Reaction, Solution"-Pattern** since the "Problem"-Part is already a designed Part of the whole Sequence, i.e. the "Reaction"-Part and the "Solution"-Part have already being placed and wait Activation after the Deployment of the "Problem"-Part.

Historical Example of the **"Problem, Reaction, Solution"-Pattern**: the **Gulf of Tonkin Incident**: Here the **Problem** was a MediaPropagation for an Attack by Vietnamese against US Naval Forces, the presidential and congressional **Reaction** and the Deployment of US armed Forces in Vietnam as **Solution**. Any Questions?

[3] Worth to note is that the Academia, (it will be interesting to trace the Sources of Funds for these "Academics" or their "Affiliations" tries very hard to discredit David Icke about this Pattern by actually redirecting the Context of this Pattern to the People that investigate this Pattern in Order to discredit them and the Pattern, but History is full of such Occurrences of this Pattern.

Remark 9.4.1.1. Patterns are available in every Domain, cover different Domains and can also *propagate* between different Domains.

Questions

1. What is "Pattern"?
2. Name a temporal Pattern.
3. Name a spatial Pattern.

9.4.2 Approaches of Examination

The **Analysis of a System** follows itself a Pattern which approaches the System from its TopFunctionality and iteratively explore it until it reaches its FoundationComponents: This is called "Top to Bottom"-Approach to Analysis. The **Design of a System** follows another Pattern called "Bottom to Top"-Approach to Design, where the FoundationComponents are defined and then they form SystemElements and Subsystems until the System is completely defined. By looking both Approaches as Analysis their Definitions are:

Def. 9.4.2.1*:* **"Top to Bottom"-Approach to Analysis:** is an investigative Method where a System is examined from its Top and then iteratively examined towards its Foundations.

Def. 9.4.2.2*:* **"Bottom to Top"-Approach to Analysis:** is an investigative Method where a System is examined from its Foundation and then iteratively examined towards its Top.

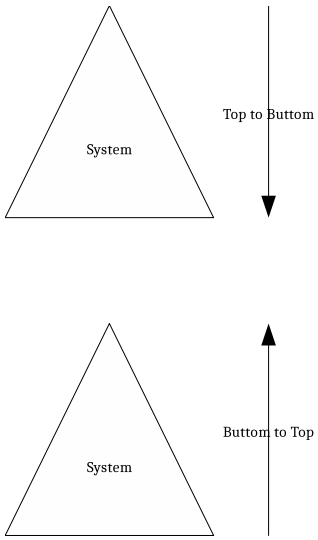


Figure 9.6: Analysis by Top to Buttom or by Buttom to Top.

See Figure 9.6 for a conceptual Interpretation.

When a System is analyzed or designed then a Mix of both Approaches can take Place in Order to progress the Study- and DevelopmentTime more quickly. Note that the "Top to Bottom"-Approach uses Decomposition while the "Bottom to Top"-Approach uses Composition.

Questions

1. What is "Top to Bottom"-Approach?
2. What is "Bottom to Top"-Approach?

9.4.3 SystemArchitecture

We can regard a System as a Building that we must understand or deliver. For this, We must conceptualize the System "architecturally". The **SystemArchitecture** provides the View of the System in Terms of its Construction, both in the functional as well as its aesthetic Domain.

Def. 9.4.3.1*:* **SystemArchitecture, De. Die Systemarchitektur, Gr. ἡ ἀρχιτεκτονικὴ τοῦ συστήματος, hee architektonikee tou systematos:** is the functional and aesthetic Construction of a System.

"Architecture" as Word comes from the Science, Art and Practice of building Constructions. Because complex Systems require Aspects that are not contained in their primary Domain, i.e. Everyone can make a Building, not everyone can make a *beautiful* Building, the Term entered different Domains of Construction concerning different Subjects.

The SystemArchitecture has two Parts the **functional** and the **aesthetic** Part.

The **functional Part** concerns itself with the provided Functionality of each Subsystem and eventually each Component. Since Demands can force the System to adapt or get optimized in the long Term, the Aspect of Adaption or Optimization of the System is very important in Order to reach the SystemMaturity. The SystemOptimization I define as:

Def. 9.4.3.2*:* **SystemOptimization:** is the act of reaching the Optimum of a System.

Initially a System is examined or developed in a minimal Manner for the Discovery or primary Functionality of its Parts. Later Details are added to increase the SystemPerformance.

In Order to understand the **aesthetic Part** of SystemArchitecture, I must to define it. Aesthetics is the Beauty of the System. By Definition:

Def. 9.4.3.3*:* **Aesthetics, De. Die Ästhetik, Gr. ἡ αἰσθητική, hee aisthetikée:** the Art and Science of Collaboration of the Principles of Pattern, Concordance and Content in complete Unity supporting the System.

E.g. In Music the Rhythm (i.e. Pattern), Harmony (Concordance) and Melody (Content) make aesthetically high

a MusicPiece.

E.g. In artistic Painting, the PaintingMethod (i.e. Pattern), artistic Continuity and Color(Harmony) and Subject (Content) make aesthetically high a artistic Picture.

Remark 9.4.3.1. To remember the Aesthetics, remember the three Words (Rhythm, Harmony and Color) and correspond them to the Decomposition of the InterestSubject.

The **aesthetic Part of SystemArchitecture** is actually quite complex since it contains (among many others):

- Elements of Beauty
- Clarity
- Distinction of Responsibilities
- Standard Methods of Cooperation and Interaction

The Term "Elements of Beauty" should be mapped accordingly to the System-Analysis. It is something that indicates a deeper Understanding. In the most primitive Form it might be Elements pleasant to the Senses, such as Ornaments, Colors, Smells, Temperatures, Sounds. In the appropriate Form it concerns how pleasant the System appears or works.

"Clarity" concerns the Visibility of the System externally and internally.

"Distinction of Responsibilities" concerns that the Subsystems have a clear, identifiable and "appropriate in Location" Function.

"Standard Methods of Cooperation and Interaction" refers that the System employs known methods to interact and cooperate internally (between its Subsystems) and externally (between the Environment and the User).

E.g. A clean Uniform will not indicate a reliable Worker that wears it. However, it adds a ReliabilityGuarantee to the Worker; this Guarantee is what the Customer sees.

E.g. A PoliceForce can train its Members (they do actually) to respect and interact with Sincerity with their Customers in Order to gain Trust and most importantly Information: the particular Interaction is the Aesthetics of the System

Chapter 10

Introduction to Study and Research in Science

Narrative

The Study of a Subject involves many Aspects. Books are the primary Source of Research for a Study but a Professional has also other Sources. The following Chapter acts as a TermInventory for the Purpose of connecting the Study- and ResearchAspects in Science. In particular it serves the Purpose of giving a general Framework for the Scientific Method concerning its Use in Sciences.

10.1 Invention and Innovation

An important Aspect of every Civilization is the Use of Tools for achieving an Objective. Even the most primitive Societies have Tools for their basic Needs: Songs [1] , Knifes, Fire etc.

One Measure for Civilization [2] is the **Invention**, i.e. a Tool that is introduced to the Society and fulfills a basic Need. By Definition:

Def. 10.1.0.1*:* **Invention:** is a Method, Process or Device incorporating new Aspects and Configurations of Items or Notions for the Solution of a particular Problem.

Though most of the People consider an Invention something completely new, the Reality is that an Invention rarely employs completely new Aspects and Configurations, therefore in a sense, an Invention is an Item or Notion or Method that was either iteratively or gradually developed. Essentially an Invention solves a Problem as the old Proverb says: *Necessity is the Mother of Invention*. However an Invention is produced by **Ability**, **Capability** and **Creativity** among other Notions that permeate the Developer of the Invention, the Inventor.

Def. 10.1.0.2*:* **Creativity, De. Die Kreativität, Gr. ἡ δημιουργικότης, hee deemiourgikotees:** is the Process of constructive Inspiration followed by Realization of Inspiration.

Though Necessity forces a Person to find a Solution, it is the innate Ability of Creativity that implements the Invention. However not all Persons have Creativity. For this Reason in Industry the Term "Innovation" was introduced in order to give the Impetus for inventing new Products, especially from Workers that do not have this Ability. In Essence, Innovation as Discipline, provides the Capability to create something.

[1] Yes a Song is a Tool! it heal Trauma or even collect Memories.

[2] There are many Measures of a Civilization. Tools as Measures of Civilization are important in Archaeology since they can be found and Conclusions can be drawn.

Def. 10.1.0.3*:* **Innovation, De. Die Innovation, Gr. ὁ νεωτερισμός, ho neoterismos:** is the Introduction of new Methods, Processes, Products and Inventions into a Field of Interest for providing the Assets required for Invention.

Because an Introduction of an Item or Notion does not necessary need an Inventor or Creativity, the Subject of Innovation is a well structured Discipline of Engineering and Management that everyone can study. You can find it under the title "Innovation Management".

Questions

1. What is "Invention"?
2. What is "Creativity"?
3. What is "Innovation"?

10.2 Subject and Investigation

In Order to understand something you need to research it. A Part of Research is the Investigation, where you look at Facts and their Connection and you try to figure out their Meaning.

Def. 10.2.0.1*:* **Investigation, De. Die Untersuchung, ἡ διευρεύνησις, hee dieureuneesis:** is the Process of exploratory as well as innovative Knowledge-Extraction for the Purpose of finding the predominant Truth.

Truth is not something relative, but an absolute Aspect that people often have different Interpretation as well as Opinion. The Investigation reveals or at least approaches the Truth and does not try to impose any other Truth in the Investigation (as have become the Fashion the last Decades). However a Person might have different View of Truth, something that is used today for asserting the Relativity of Truth and consequently is used to discredit Facts or Opinions in Favor of official Policies. Known Example was the Story of Covid-19 where Side-Effects of MrRNA Vaccines were discredited by Governments but now they are accepted, as well as the Accidents in the Laboratory that investigated the "Corona Virus"-Strains where the Accidents were discredited as Misinformation but later were accepted as Truth. See Bibliography [BBC] and later [Oversight].

Examination is an ObservationTechnique that has the Purpose to find something about a Subject. It is used as a Tool to add Facts into Investigation.

Def. 10.2.0.2*:* **Examination:** is the Act of observing and interacting with a Person, Animal, Item or Notion in order to extract Knowledge and consequently support an Investigation.

Comparing "Investigation" and "Examination", sometimes are used interchangeably, but of Course are different! The "Investigation" concerns all the Aspects of the Subject, while "Examination" concerns all the Aspect of a SubjectPart.

We have previously defined "Knowledge" as well as "subjective" and "objective", where "Subjective" and "Objective" refer to a Fact based on Belief or Proof respectively. During an Investigation the Terms "Subject" and "Object" appear, the one is a short for "**Subject of Matter**", that is, the **Notion** we investigate, while the other is a short for "**Object of Matter**" which is the **Purpose or Result** of your Endeavor. In other Words: We inspect (i.e. investigate) an Area (the Subject of Matter) for a Purpose (or Result)(the Object of Matter). The Act of Traveling to the Area is our Study (the Endeavor we have taken).

Def. 10.2.0.3*:* **Subject of Matter AKA Subject from the Latin "Subjecta Materia", i.e. laying Matter from**

Greek ἡ ὑποκείμενη ὕλη, De. Das Subjekt: is called the Notion (AKA Material) under Investigation.

Def. 10.2.0.4*:* **Object of Matter AKA Object from Latin "Objecta Materia", i.e. Matter under Observation, from Greek ἀντικείμενη ὕλη, De. Das Objekt:** is the Result or the Purpose of the Investigation of the Subject of Matter.

Please keep safe the words "Subject of Matter" and "Object of Matter" in Order to clear the LanguageUse from unintentional (and false!) Consequences, such as "Subjective" equals "Subject of Matter" and "Objective" equals "Object of Matter".

Concerning Examples of "Subject of Matter" and "Object of Matter" here there are:

E.g. In order to acquire Knowledge, we investigate the Subject of Matter "FootBall" for the Object of Matter "Average Age of CareerEnding of a "FootBall"-Player". Here the Object of Matter is the **Purpose of Investigation**.

E.g. In order to acquire Knowledge, we investigate the Subject of Matter "Electronics" for the Object of Matter "Circuits that Perform the X-Waveform". Here the Object of Matter is the **Result of Investigation**.

Questions

1. What is "Investigation"?
2. What is "Examination"?
3. A Guy studies a MurderCase and finds out that a vital Part of his Study are the Rooms of the Victims. What is here the "Investigation" and what is here the "Examination"?
4. What is "subjective"?
5. What is "Subject of Matter"?
6. What is "objective"?
7. What is "Object of Matter"?
8. A Guy studies HairDressing and finds a Page in the Book about Haircuts of the Period 1980s. What is the "Subject of Matter" and the "Object of Matter"?

10.3 Exploration and Searching

In order to explore the World, we need certain Tools that will assist our Endeavor [3] . For Example, if we want to explore History, probably we will need a Purpose for Exploration as well as a Plan for the Exploration and not to forget the Tools for the Exploration which are defined for the Subject of Matter itself. Lets put these things together in an Example:

- Subject of Matter: History
- Purpose of Exploration: to seek historical Information.
- Plan: Assemble the Data and a Team of Professionals with Experience on the Subject and send them to investigate.
- Tools: Tools to find the Truth according to standard and accepted Practices.

On the way of your Planning you discover that your Investigation has conflicting Results. Now you are starting to get deeper and accumulate Aspects that you didn't foresee. And you haven't even started.

Because Exploration is a dangerous Task, we need to clearly define it.

Def. 10.3.0.1*:* **Exploration:** is the Visit of an Area of Interest for the Purpose of KnowledgeAcquisition.

[3] E.g. Weapons and Democracy ☺.

The Exploration is part of the Research and is supported by Investigation.

An Exploration can be physical or notional. A **physical Exploration** access a physical Area and looks for Knowledge. A **notional Exploration** access a notional Area such as a scientific Subject and looks for Knowledge. Keep in Mind here, that **Exploration is NOT Searching.**

Def. 10.3.0.2*:* **Searching:** is the Visit of an Area of Interest for the Purpose of DataAquisition.

While "Searching" looks for particular Data, "Exploration" looks for any Type of Data, in Essence "Knowledge". In this way there is very low Probability for Exploration to introduce Bias to the Investigation, that is to influence the Investigation so that the InvestigationResult shows the Beliefs of the Observer.

Def. 10.3.0.3*:* **Bias:** is the Influence affecting Results according to the Inclination and Beliefs of the Observer, a Source of Interference or the DataSource itself.

Because People have their own Prejudices and Predispositions they Introduce Bias which can affect the Results to the Views that they hold. E.g. A highly religious Person will consider a stellar Phenomenon according to his religious Views and describe it accordingly as a Miracle. A Scientists does not have this Luxury: his Purpose is to explore; but he can search and only accordingly to well defined Data belonging to a particular Property.

In DataAnalysis, the Term "**Exploratory DataAnalysis**" encloses the Methods and Processes to perform DataAnalysis by allowing the DataSources to reveal all their Data, such as the Investigator will consider all the Views present in his Exploration and not his own Beliefs and Inclinations [4] .

[4] According to [Martinez et al]: Exploratory data analysis (EDA) is quantitative detective work according to John Tukey [1977]. EDA is the philosophy that data should first be explored without assumptions about probabilistic models, error distributions, number of groups, relationships between the variables, etc. for the purpose of discovering what they can tell us about the phenomena we are investigating. The goal of EDA is to explore the data to reveal patterns and features that will help the analyst better understand, analyze and model the data.

Questions

1. What is "Exploration"?
2. What is "Searching"?
3. What is "Bias"?

10.4 Research

We defined in previous Chapter the Term "System" as a Cooperation and Interaction of Components for the Provision of something useful. The Term "Systematic" concerns the Aspect of Cooperation and Interaction regarding to a particular scientific Behavior.

Def. 10.4.0.1*:* **Systematic (Adjective), De. systematisch, Gr. συστηματικός:** based on disciplined Behavior and employing Method, Rules and Plan.

Based on that, **Research** is an Endeavor (you succeed or not) that you use in order to Study the World as well as to create new Products and Processes. With this in Mind:

Def. 10.4.0.2*:* **Research:** is the systematic Endeavor for KnowledgeExploration, Innovation and Invention.

During the Research we set some Objects of Matter that must be supported by Evidence of their Existence (or Performance). "Evidence" is defined as:

Def. 10.4.0.3*:* **Evidence:** is a any Mean that supports a Fact.

By regarding the Object of Matter as Fact we can (or not) provide Evidence for its Existence. By collecting Evidence we

can provide a Proof. A Proof is defined as a System of non-conflicting Evidence in this respect [5] .

Questions

1. What is "Systematic"?
2. What is "Research"?
3. What is "Evidence"?

10.4.1 Qualifications for Research

A Researcher can be any Person that can perform Science. However, the Qualifications are important since not every Person can perform DataAnalysis and mathematical Modeling (to name a few); therefore in real Life, a ResearchProject targets People that are capable to use the Tools mentioned: these People are qualified Technicians or Scientists and are obliged to follow "by letter" the ResearchMethods. However, Research into new Areas, often called "original Research", does not necessary need a Qualification, since the Persons who do such Research are doing it under their own Funds and Interest [6] .

10.4.2 Tools of Research

There are Tools for Research in order to fulfill almost every Aspect of the Endeavor. Some of these are [7] :

- Recorded Information
- Interviewing
- FieldWork
- Experiment
- Standard Methodology according to ScienceBranch of Interest.
- Rules and Regulations for performing Research.

The **recorded Information** has the following Sources:

- Text
- AudioMedia
- VideoMedia
- Images
- Numerical Data
- Other Data

The **Interviewing** is a Process where you contact Witnesses, Specialists, or People associated the ResearchSubject. **Fieldwork** is the direct Contact with ResearchSubject whether you visit a hospital for PatientInterviewing or a Hill for geological Sediments [8] . **Experiment** concerns the ModelTesting in order to either discover, verify, modify or reject the ModelHypothesis. The **Standard Methodology** is Methods and Processes concerning the InterestField to perform the Research and Experiments if any. These are rough Definitions that I will not consider as final. You must to make your own Training on these. Now step aside, you step on my Foot all these Minutes!

[5] A Definition of Proof will be given in MathematicsSection of this Book. For now consider that Proof is a Set of separate Evidence that support an Argument.

[6] Speaking of which, Me, Chris Neufelt, took the Time and Resources to write this Document, since there were no good Books about the Subjects I cover. Whether or not my Book is Crap or Excellence, only Time will judge. I don't have any Degree in ScienceStudies or cognitive Sciences, and I am only an Engineer (though I study many Subjects on myself to keep me on the Edge).

[7] I don't provide here an extensive List since every Research has its own Specification of Tools.

[8] or just watching the Chicks playing Volley while you are paid for geological Research

10.4.3 Steps of Research

The following Steps in Research are not necessary in Sequence. Frequently a new Information or a false Datum can reset the Research. For this Reason, is always suggested an Iteration of all (or most) Steps during the ModelRevision. In Addition, some steps can be merged depending the Simplicity of the Model or Investigation.

1. Observation of Problem or Phenomenon
2. PurposeFormulation
3. ProjectPlanning
4. Definitions
5. ModelHypothesis
6. ModelConstruction
7. ProblemExploration
8. DataCollection
9. DataVerification
10. DataOrganization
11. DataProcessing
12. DataAnalysis
13. DataInterpretation
14. ModelRevision
15. KnowledgeExtraction or SolutionImplementation

10.5 Bibliography

• [Martinez et al]: Wendy L. Martinez, Angel R. Martinez. Computational Statistics Handbook with MATLAB. Chapman & Hall, CRC Press, USA, 2002.

• [BBC]: https://www.bbc.com/news/world-asia-china-57268111

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Chapter 11

Critical Thinking

11.1 Narrative

Critical Thinking is a Requirement for a Citizen, as well for a Scientist, that is demanded but tactically neglected since good Citizens and Scientists pose a Problem to the Control of HumanSociety by those who seek its Enslavement [1] . The less the Slave, i.e. Citizen, knows about his Slavery, the more he remains a Slave [2] .

With this in Mind, I understand that the only People that are allowed critical Thinking are People that Control this World and some People that their Science in the short Term does not collide with the Interests of the People that Control the World.

E.g. Researching **Banach Spaces** will not cause you Troubles. Mapping Banach Spaces to practical Philosophy and Action under some clear Conditions that give scientific Results can cause you Problems because you may find out that your Science conflicts with the *official and accepted social Narrative* [3] .

Saying that, exists also the true Revolutionaries that use critical Thinking, with main Indicators for their Compass, the **Truth and Justice**. Though Truth can be considered as something subjective due to the overwhelming Relativism, within a limited Region can be considered objective. E.g. *Murder* is something that we consider as Evil in a Society [4] . Saying that, a true Revolutionary will abandon his Ideology if his Ideology comes into conflict with his Ideals, Values, Principles and Virtues.

Having clarified the Reasoning behind luck of Critical Thinking in our Society, I must to clarify the following Aspect of social Interaction: Once you acquire the Skills to become critical Thinker you enter the TruthDomain (but at the first Steps the one of Objectivity). This Domain eventually brings Conflict to you since

[1] Who are the Persons that will look for an Enslavement of Society? This is easy: Persons that seek Power AND Validation of themselves. These are specific Leaders of any Part of Society and History has shown many of them and their enslaving Policies.

[2] *And for this, Camel are the Cigarettes that most of medical Doctors smoke.* [1949, Advertisement for Camel]. Just a Reminder that Corporations can go the full Road to persuade you to their Objectives; Historians and Murderers also.

[3] State IntelligenceServices are known to have researched Aspects of social Engineering from the very mathematical Point of View. However, some Requirements for Research are fulfilled from Universities and MilitaryAcademies. Here is a very minute, now public, List of interesting Subjects: [Fucked Up]. Regarding my personal Study to these Subjects and as a Greek Singer once said, "**Many things my eyes have seen, but this brings me terror**".

[4] We consider Murder as Evil since Humans are social Animals that build Trust to make a Community so that each individual Member can survive. Murder, that is, the **unlawful Killing** is condemned as Destruction of this Trust that the Community is based upon, and consequently is punished severely even with Killing the Murderer. Notice that the word "Killing" is not associated with Murder; you can kill to protect someone and this is not criminal Intent.

Persons have different Opinions and frequently will religiously as well as merciless defend these Opinions because they have invested much Effort to maintain them as well as enlarging them to accommodate their personal Beliefs. In other Words *you will be blessed with Conflict. Congratulations.*

Conflict is a Bless since is what keeps you alive both physically, mentally and of course *spiritually* since mobilizes your DefenseMechanism to keep you in full Performance.

Remark 11.1.0.1. By my Experience, the most active People are the ones that have the most Enemies. I salute you for this Gift!

Remark 11.1.0.2. By my Experience, the most hated People and Ideas are the most alive ones.

[5]

Another Aspect that I must mention is that *critical Thinking is a continuous ImprovementProcess that you must integrate in your intellectual Life by applying it without any Considerations of your personal Beliefs and emotional Demands.*

E.g. I love Tigers and I can hold a "tamed" Tiger with my Arms in Order to fill emotionally complete, but my Intellect tells me that the Genetics of this Animal impose a HunterInstinct, thus the Tiger can suddenly attack and does attacks HumanBeings; even if I love Tigers, they are still high performance Killers that I must respect them as such.

Many Thoughts are Tigers and you should treat them as such. The same for your Alertness to the ImprovementProcess since non critically examined Thoughts eventually tend to bite, i.e. come into Conflict with your scientific Reality.

[5] This of Course can serve as an Exercise since once you identify the Ideas or Persons you must find out which Aspect of Civilization is most affected by the People and Ideas. You will be surprised how much less you know as you explore this Aspect.

11.1.1 Who the Fuck are you to talk?

Speaking about **Thinking** there are three main Sciences (and Disciplines) that are involved with it:

- Philosophy
- Psychology
- Neurology
- Mathematics

I don't have any degree on them! The only Thing that I have is that I studied on my Time some *very small Regions* of them, in some particular Subjects such as "Thinking". Keeping that in Mind there are Books found in the Bibliography that refer to the **Subject of critical Thinking**. In Addition you can find some lovely Courses around you, as well as Study on your own this Subject to compare my Information. Thank you in advance, *get the Hell out of this Subsection.*

11.2 Critical Thinking

Scientific Verification is an Aspect of any scientific Endeavor where the Object of Matter is tested for its Validity. If the Test confirms Validity everything is in Order, while if the Test confirms Invalidity, then the Scientist must reconsider his Research. *Sometimes even his Career* [6] .

[6] Imagine the psychological Mood of the Historians as someone irrelevant to the field as Heinrich Schliemann, an ex-Waiter that build a Career as a wealthy Businessman went to Asia Minor and excavated (without use of Dynamite as many English Archaeologists of his Time used to do) the ancient Troy. Mythology might be Tales, but there is always a historic Aspect to it. This Example told Historians that Mythology needs also scientific Verification for its Association with History. By the Way, the Term "Myth" it means unwritten or very old History in ancient Greek.

The first Term that I define here is "Thinking", the directed mental Activity.

Def. 11.2.0.1*:* **Thinking:** is the mental Activity of Data-, Fact- and Information-Processing.

Critical Thinking is a continuous improvement Process which Analyses the available Information to its Constituents and consequently tests the Information in Order to form a Judgment. It is defined as:

Def. 11.2.0.2*:* **Critical Thinking:** is the rational InformationAnalysis based on Principles of InformationTesting.

The Word "critical" denotes "providing Judgment", while the Word "Thinking" is appended to describe the Process of DataAcquisition, InformationAnalysis and InformationSynthesis.

Another Definition is:

Def. 11.2.0.3*:* **Critical Thinking:** is the InformationAnalysis for performing a Judgement.

Remark 11.2.0.1. If the Critical Thinking was only InformationAnalysis, then there will be no Requirement for constraining the AnalysisDomain and consequently there will be Analysis of all possible Views, even Views that do not contain any Rationality. By having a *pending Judgment*, we are forced to constraint ourselves to a smaller AnalysisDomain of fewer Views.

Critical Thinking as a Process demands that the Thinker (here the Scientist) will apply various Skills to his Analysis in order to judge his Information. Here is worth to understand that many Skills mentioned are common in other Sciences such as Mathematics, Philosophy and Physics. The Application of each Skill will be later mentioned but here are the Skills [7] :

- Selfreflection
- Selfregulation
- Selfdiscipline
- Comprehension
- Analysis
- Either logical or scholar Inference
- Systemic Understanding

Each of these Skills needs some Time to be read but much longer Time to be formed. Especially in Academia, where many Scientists believe that they hold the absolute Truth this is particularly manifested by the Luck of QualityWork [8] .

Each of these Skills will be presented in the next Chapters. But beware: Each scientific Area has its own **DiscoveryProcesses**, **Standard Operating Procedures** and **Tools**; the critical Thinker must understand all these Items before he make his own Judgment. In addition, since the Road to scientific Research is already paved by the previous Researchers, the critical Thinking is easier, but still hard Work needs to be invested for him to **discover**, **develop** and **map** new Regions of Exploration. But here a Caution that is not written in the Books and concerns my own View:

Remark 11.2.0.2. You cannot teach Thinking: you can only prepare for Thinking.

Despite the political Motivation to color everyone on this World equal, in Reality,

[7] Some Skills were advised by [Heard et al]. I included some of these but I give my Interpretation of the Terms mentioned.

[8] Worst offenders in this Area are Scientists from Countries with minimum academic Performance where the Title of Scientist is accompanied by the Myth of respectable Profession and Social Status: these Countries produce mostly average or below average Performers of Sciences. Things will eventually change (only severe Punishment, i.e. Hitting, is missing from their academic Domain), but not soon.

People are not equal, but equal with respect to the Law [9] . This Inequality also applies to your Abilities and Capabilities, otherwise there will be Indifference to the World: Indifference to physical subatomic particles, Indifference to Emotions, Indifference to Colors (no Colors!), which all means a Luck of Diversity and thus Luck of Interaction.

That you are being able to think, does not mean that you are capable for critical Thinking; you can learn some Things, but you cannot necessary achieve critical Thinking. My Purpose in this Book is to show you the different Views of Thinking. The Work to prepare for critical Thinking is up to you.

Thinking is a complicated Process that is not well Understood, despite the Claims from many "Authorities". You are constraint from your Multiple Intelligences (Howard Gardner anyone?) and Experiences, both in your scientific as well social Domain and Beliefs.

Personally I can only give you my Tools and you can try them; at the ChapterEnd, near the Stack of of *Soldier of Fortune* Mags where the Cat currently sleeps, exists a Bibliography about it.

Now lets define the Aspects of critical Thinking.

11.2.1 Fucked Up Bibliography

While the Book is said to be Man's best Friend, Neufelt said that Research can be the Man's greatest Enemy. The Bibliography provided is just a very small Indication of the Subjects that really shape HumanHistory. No its not to heal People but murdering them *politely*.

[9] i.e. you can get a fair Trial if you are prosecuted for a Crime irrespective of your Background. Concerning the Society, you must to accept that any Person might treat you as he wishes, and this is the Side that you must accept and conform accordingly; is not the Responsibility of the State to meddle with the interpersonal Relations of their Citizens, its your Responsibility as long that nothing illegal happens.

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Chapter 12

Selfreflection and Selfregulation

Narrative

A Reflection of an Person at a Mirror, identifies the Person. If the Person has an Intelligence to regulate himself then, by looking at the Mirror, the Person can correct himself. This Reflection and Regulation happens all the Time, starting from the daily Ritual in the Bathroom, where you look yourself in the Morning and you dress your Hair.

Selfregulation and Selfreflection are two Properties that are Part of the "critical Thinking"-Process that I now explain.

12.1 Selfreflection

Look yourself in the Mirror [1] and then consider that there is a similar Process to look deep inside you. This Process is called Selfreflection.

Def. 12.1.0.1*:* **Selfreflection (AKA Introspection AKA Selfobservation):** is the Ability to monitor your emotional, logical and cognitive Processes in Terms of the Object of Matter.

In this way, you can ask yourself Things that normally you will not answer to other People. These Things are a *Taboo* to you and you have the absolute Privilege of exercising Honesty without Fear of Punishment [2] . But in any case the Selfreflection gives you absolute Control to revealing yourself. However it might well mislead you if you are attached in a Belief since Belief introduces Bias to the Measurement of Selfreflection leading to erroneous Conclusions.

E.g. Believing that you are virtuous, while you do unethical Actions will not help during the Selfreflection, since you have already a Bias in your Measurement.

The ancient Greeks said "Know yourself" as critical Component of intellectual Freedom [3] ; Selfreflection assists precisely this Freedom, but Selfreflection demands some other Tools. These are:

- RecordDevice such as Paper and Pen. Here you exercise the MemoryComponent of Selfreflection which will give you the Data you need to start.
- Set of Questions associated with the Object of Matter. Questions can also be chained giving Evidence of Association.
- A decent TimeDuration to selfreflect.

As an Example on the Issue of Questions, consider **Psychological Evaluation Tests**. These are well researched Documents (called "Instruments") that provide an Evaluation of PersonalityTraits

[1] yes you are ugly

[2] Of course later you can still get the whiplash to hit your back.

[3] Actually this is an Epigram in Temple of Apollo, Delphi, Greece. We assume that this is what is meant. Plato ascribes to Socrates in his Apology the Citation that "an unexamined Life is not worth a Living", precisely this Aspect.

based on Answers of a Person. Their Questions can be really deep and sometimes hurting. However once answered you get a Snapshot of your PersonalityTraits during a particular Moment of your Life [4]

A significant Exercise to do when you perform Critical Thinking is to selfreflect on the Issues affecting you concerning the Object of Matter. In this Case:

- Write on Paper the Title of your Selfreflection on the Object of Matter.
- Reflect on the Object of Matter and its Effects.
- Write after the Questions that arise from this Selfreflection.
- Eventually identify a Pattern that each Question or Group of Questions reveal.

Though this Process can be somewhat abstract, you must understand that you do it automatically when you are thinking about a Dilemma or an Event that deeply impact you. The only Thing here is asked you to do is to perform this Action with Reason and Structure.

The Myth of Perseus places Perseus in a Temple of Goddess Athens where he fights the Gorgon Medusa by using his gold plated Shield as a Mirror that reflects Medusa, since the Gaze of Medusa makes everyone a Stone; using the Shield as Mirror, Perseus fought Medusa and eventually cut her Head. For this Myth, I regard that Perseus, i.e. the Person committing Selfreflection, used his Reason (the golden plated Shield, i.e. Reason shields you from the Monster of Belief, in addition, Reason reflects on Belief), to attack Medusa, i.e. the Belief, which otherwise Medusa (the Belief) turns the Persons into Stone, i.e. Belief immobilizes the Persons.

[4] Instruments record only Moments of your psychological (as well as neurological) State. A good Book with Instruments is the **The psychologist book of personality tests** by **Louis Janda** (RIP).

Questions

1. What is "Selfreflection"?
2. After you do this Question you destroy your Answer unless you hold a Diary where this Answer belongs. Take Time away from anyone as well as your Duties. Before the Exercise, collect a list of Adjectives concerning the Behavior of a Person or his Psychology (you can find such a list). Write on Paper an Event where you feel Guilt about something you did in the Past; the Guilt is the Object of Matter. Write down its Effects on you. Write down the Event that you cause and identify the Patterns of your Behavior.

12.2 Selfregulation

A physical Process is typically regulated from an outside Factor because a physical Process is always unstable [5] . A System that has the Ability to regulate itself is called "**selfregulatory**". Concerning a Person, the Selfregulation affects his Thinking and Thoughts directly or indirectly, as well as consciously and unconsciously.

Def. 12.2.0.1*:* **Selfregulation:** is the Ability to affect the emotional, logical and cognitive Processes concerning the Object of Matter.

A System regulates itself when it observes its Outcome and affects it towards a Goal. Obviously this is more difficult that Selfreflection since the System contains a Process that must change, i.e. you don't simple *observe the Process*. For example, an illicit DrugUser (AKA "Junkie") can observe his Misery but he finds extremely

[5] Here I regard all fundamental Processes as unstable Mechanisms. It is the Existence of a SensingMechanism called "Feedback" that monitors and corrects an unstable Mechanism.

difficult or impossible to regulate his Dependency on Drugs due to the Complexity of Interaction of the illicit Drug with his neurological System.

Similarly in the Context of critical Thinking, Selfregulation involves measuring the mental Outcome against a Goal or against the Performance of a Goal and taking the appropriate Steps to correct the mental Outcome if the Need arises.

E.g. When you study a political Text you must ask yourself if the Ideas presented are feasible by checking the Outcome of the Ideas in the real World. What the Effects of an Idea such as Equality of each Person? What about Equality of Income?

Tools for Selfregulation are the following:

- RecordDevice for recording Memory
- ComparisonProcess for mental Outcomes (i.e. Establishment of Criteria for the Comparison)
- Flexibility on affecting the mental Outcome
- PerformanceGoals
- OptionsExploration

Considering the **ComparisonProcess**, Selfregulation demands a Comparison of the mental Outcome to the Facts irrespective any possible Conflict; *we simple demand the Truth.* On **Flexibility on affecting the mental Outcome**, we need to use any ThinkingForm delivering us plausible Results irrespective of our Beliefs. Beliefs are not Proofs! Setting Goals and PerformanceGoals will eventually increase the Level of Performance towards our Thinking while exploring various Options we can open ourselves to new Fields of Discovery and Development.

Questions

1. What is Selfregulation?
2. This Exercise is a friendly Reminder of how much difficult is to regulate an unstable Process as yourself. Find the most hated Idea you have encountered and compare it to a Solution against it that is already used (Just write the Names of the Ideas). Now set as a Goal to prove that the hated Idea is right. Find at least one Argument that you can support and write the Reason about your Support.

Chapter 13

Selfdiscipline and Comprehension

Narrative

While Discipline is the Teaching of personal Control, the Issue of Comprehension is equally important in order to enforce Discipline. In Effect, here the Learning-Process requires both Concepts to check each other so that the Goals of Learning are achieved.

This Chapter concerns the Enforcement of Discipline by the Will of the Thinker as well the Regulation of Comprehension.

13.1 Selfdiscipline

Selfdiscipline is both a genetic Aspect as well as a learned Capability. I define "Selfdiscipline" as:

Def. 13.1.0.1*:* **Selfdiscipline, De. Selbstdisziplin, Die ἡ αὐτοπειθαρχεία:** is the Process of enforcing Constraints into your Actions in order to perform a Duty.

E.g. As a Policeman you have the Selfdiscipline not to commit any sexual Relationship with a Person involved in a Case no matter how much you are attracted to her, i.e. You should be fully in Command of your Penis.

With Selfdiscipline you are the Master and Slave of yourself and you are the Target of the InterestConflict between your Leisure and your Duty; in this Case you face always the Consequences of this Conflict, which are Confusion and Enragement [1] .

E.g. Try to sit at the front of a warm Plate of Food while you haven't eat for two days.

Concerning critical Thinking, the Selfdiscipline plays a significant Role to constraint the Mind to its mental Focus: you have a Work to do (to think!) you must do it on the Issue at hand. Moreover you have to apply properly the Methodologies for Thinking even if they get you into the "Non Comfort"-Zone.

E.g. The Study of criminal Law involves actual CrimeCases where the Evidence are very vividly provided (i.e. *He took the Baby and start to hit it with a Hammer* etc.). The Selfdiscipline here is not to personally process the Information.

E.g. The Study of ComputerProgram-

[1] These Consequences are critical for mental well-being, since real mental Life has always internal Conflicts; Only Idiots and Psychopaths have no internal Conflicts and for them we have Monasteries and Hospitals (on better Times also Tortures and Executions). As a real LifeExample, most of the Policemen that were related to the Case of "Grooming and Rapist"-Gangs feel completely helpless and in total Enragement for the luck of Punishment for the Criminals that were let free from the JusticeSystem of UK and USA; it needs very strong Selfdiscipline to make the "blind Eye" to a Criminal acquited for his Crime. As an Exercise, take 5 Minutes now, imagine what is like to be raped, you and your Sister, by 5 Individuals which are then found, ignored, after many years judged and then run as free Men from the Court. Do you feel the hot Shit in your Mouth? This is how a Policeman feels when he cannot punish Crime. *The Victim on the other Side, feels it every day.*

ming involves many Technologies which can divert the Student from his Focus. The Selfdiscipline here is to allocate carefully your available Time and StudyMaterial so that you perform the Study.

Selfdiscipline is by my Opinion should be "Project"-based according to the Tasks and Duties at Hand. In **ProjectManagement** the three important Aspects [2] are:

- **Scope**: What you want to achieve.
- **Time**: The Duration you give for the Endeavor.
- **Resources**: The Material and Help you need to achieve the Endeavor.

For Selfdiscipline concerning critical Thinking, I choose that the **Scope** maps to the Idea that no Matter where the Thinking leads me I will remain to the **Object of Matter** even if it challenges my own Beliefs. The **Time** that I need for my critical Thinking should be a robust TimeBlock where no outside Interference will engage me. The **Resources** that I use for maintaining Selfdiscipline is my Office which is quickly accessible only for my Research concerning the Issue at Hand.

Questions

1. What is "Selfdiscipline"?
2. What are the three Aspects of ProjectManagement?
3. How you will use Selfdiscipline in critical Thinking?

13.2 Comprehension

Comprehension is the complete Understanding of something from any View sharing the same Context. By Definition:

[2] See for the full Catalog of Aspects of ProjectManagement.

Def. 13.2.0.1*:* **Comprehension, De. Das Begreifen, Gr. ἡ Κατανόησις, hee Katanoeesis:** is the Ability to gain complete Familiarity with the Object of Matter.

E.g. If you comprehend numerical Addition, you understand the Meaning of increasing something irrespective of what this something is, i.e. 2 and 3 make 5 irrespective if are all Oranges, if all are fruits, if all are Idiots, if all are Definitions that you must to learm.

In critical Thinking you need to gain Access to Information by viewing the Information from all its Views and essentially being able to mentally **locate the Information** as well **describe the Information**. Once you are in this Level of Understanding, you can process the Information.

Comprehension is nice but is limited from various Aspects which by my Opinion the most important are:

- **Memory**: you cannot comprehend if the ComprehensionObject is complex. You need to analyze it to its Constituents, Connections and Configuration, and memorize them; the Memory you have, limits the Comprehension you exhibit. Some heuristic Strategies for Learning might be here valuable.
- **Limited Information concerning the Object of Matter**: a serious Research always is limited by Luck of Information. Luck of Information impedes Comprehension since many Questions left unanswered.
- **Education**: you cannot comprehend something complex if you have limited Education. You will find out, that some difficult Concepts need a further Investigation that you need to comprehend before you achieve comprehension on them. Available Time is here the Key.
- **Beliefs and Genetics**: some of us are born limited in intellectual Abil-

ities and we are also shaped by Beliefs. Both Aspects impede Comprehension.

A simple Exercise for increasing Comprehension is to read carefully and find the Solution of an Enigma AKA Riddle.

Def. 13.2.0.2*:* **Enigma AKA Riddle:** is a Question involving complete Comprehension of its Formulation and resolves in an unexpected Answer.

Remark 13.2.0.1. The unexpected Answer enforces Memorization.

Remark 13.2.0.2. Riddles are used to demonstrate common Patterns.

An Enigma may contain a Metaphor, something famously described in the Greek Mythology as the one that the Sphinx gave to Oedipus[Ellis]:

What animal is that which walks on four legs in the morning, two at noon, and three in the evening?

The Answer was given by Oedipus was:

Man is the animal; for, when an infant he crawls on his hands and feet, in the noontide of life he walks erect, and as the evening of his existence sets in, he supports himself with a stick.

You can find Books on Riddles in a Bookshop. However here is a Problem with Riddles: they require Experience and Persistence, which are Qualities not widely available; in Addition, in the old Books that I have seen there is no Level of difficulty and this can cause Problems to keep reading the Book, something that you should keep in Mind.

Another simple Exercise for increasing Comprehension is to read small Articles (2 to 3 Paragraphs) about medium to difficult Subjects and then try to figure out what is mentioned. Variety of Articles is here a "Treasure".

Questions

1. What is "Comprehension"?
2. What are the Aspects that impede Comprehension?
3. What is "Riddle"?
4. Which is a Subject of Matter that you Excel in Conversation with Friends or professionally? What helped you to become a specialist on this Subject of Matter?

Chapter 14

"Critical Thinking"-Analysis

14.1 "Critical Thinking"-Analysis

In critical Thinking there is a Demand for Analysis of the **Object of Matter**. I define Analysis as:

Def. 14.1.0.1*:* **Analysis:** is the Separation of Something to its Constituents.

while then I define **"critical Thinking"-Analysis** as:

Def. 14.1.0.2*:* **"Critical Thinking"-Analysis:** is the Separation of the Object of Matter to its SystemConstituents.

The "Critical Thinking"-Analysis receives the Object of Matter as a Statement [1] and performs the following Tasks [2] , [3] :

- **Identifies the Assumptions and the Facts within the Object of Matter**. Assumptions are Marked before they are stated as "(Ax)" where "x" is a Number, while Facts are marked before they are stated as "(Fx)" where "x" is Number.
- **Identifies Arguments and Counterarguments**. Arguments are Marked before they are stated as "(Arx)" where "x" is a Number, while Counterarguments are marked before they are stated as "(Carx)" where "x" is Number.
- **Identifies possible Contradictions**. Contradictions are denoted as "(Conx)" where "x" is a Number. Each Contradiction should reference the Facts and Arguments, such as e.g. Con5 Ref F12.
- **Breaks the Statements to Parts if Comprehension is impeded by Context.** Sometimes you need to even to associate a WordSequence as one Word because it contains very problematic Use of Prepositions, Adjectives and Nouns. Here the Use of HighlighterPen is a Virtue.
- **Associates each Part with the Object of Matter**
- **Reiterates on the previous Tasks for Checking and Optimization of Thinking.**

[1] Here the Word "Statement" refers to a Document that specifies the Object of Matter. When you study the Subject "Documentation" you will encounter Documents named "Statement of..." which describe the Object of Matter. Titles that I have reviewed during my Work: Statement of Finances, Statement of Regulations among others.

[2] This is my Methodology but I wouldn't be surprised for similar Ideas before me. A Reasoning behind the free Content of this Book is that the Mafia of Publishers, Attorneys and some small Corporations are willing to go to War on intellectual Properties or even non existing intellectual Properties simple to gain Money by embracing the intellectual Property of the Poor for themselves. On the bright Side, they are killed by Criminals while walking on their Cities for no Reason. This is Nature's "Darwin"-Award since the Killed (I don't call them Victims) didn't contribute anything to keep Civilization going.

[3] Many newly introduced Terms will be defined when their Time comes.

Professional Organizations have their own Methodologies and Standards for Analysis in their own Fields. These Methodologies give also some Clues about the Subject at hand as well as critical Thinking; this is more apparent in critical Systems where **LifeLoss** can impose legal, financial and moral Penalties.

As EyeCandy I also provide, is the Definition of Analysis that CIA(the Central Intelligence Agency of USA) has given concerning its Processes:

Analysis (IntelligenceServices): *A process in the production step of the intelligence cycle in which intelligence information is subjected to systematic examination in order to identify significant facts and derive conclusions therefrom.* [CIA]

The Analysis of the Definition "Analysis" reveals here:

- Analysis is a Step to produce Information
- Analysis is Part of the Process of IntelligenceGathering
- During Analysis Information is systematically examined for Facts and ConclusionDerivation.

The next Chapters consider in more Detail the Subjects of Language (Grammar and Syntax) and Logic (Arguments and their Evaluation). Both Subjects are given in an introductory Fashion, so that a FrameWork can be established for later Investigation.

Questions

1. What is Analysis?
2. What is Critical Thinking Analysis?
3. Name the provided Items of the Methodology for Critical Thinking Analysis.

Chapter 15

Logical Inference and Proposition in critical Thinking

Narrative

Having in our mental Arsenal of critical Thinking the previous Items, we are in the State, of being ready with the first Part of critical Thinking, that is the **Inference** [1] . The Second Part is of course the **systemic Understanding** (which comes last in this Unit).

From now on we have entered the Domain of Logic, that was scientifically arranged by **ancient Greek Philosophers**, in particular **Aristotle**[Aristotle] and it still used today, after many Iterations that added scientific Notation and more constrained Content. Later, in the Section of **mathematical Logic**, the Ideas given here will be expanded.

You must understand before you begin, that the Methods and Processes provided are very simplistic and designed here to provide you with a systemic View. The hard Work starts once you have Experience from your Area of Endeavor and you apply actual Tools, Methods and Notations.

A Word of Caution, is that many Scientists are not always in Concordance with the Issues of Definitions, Deployment of Concepts and Notation; this is the Price that someone has to pay for describing something so fluid as HumanThinking, especially when this spans on different Contexts.

15.0.1 Scientist, Scholar and Logic

A **Scholar** is a Person that studies something in great Detail. He can be anyone, including a Scientist or Joe the Farmer; however Persons studying Religion are typically get this Title, since they are trained as Scientists but are researching Religion, which is a completely different View of Reality (See **Worldviews**) based on Beliefs. Consequently their Endeavor does not have scientific Gravity in the Sense of classical Science, but academic [2] .

On the other Side of StudyingSpectrum, a **Scientist** is a Person that studies Science and uses the scientific Method. One Part of the Method is the **Use of Logic** to his Endeavor.

Def. 15.0.1.1*:* **Logic:** is the called the Study of valid Reasoning and Proof.

[1] For now until its Definition, **Inference is the Method of considering Facts and drawing from them a valid Conclusion.**
The Management

[2] Academic Gravity means that a Subject is scientifically studied, but does not offer a scientific Contribution, at least in the Sense that we want to have. Saying that, the Study of Myth ***is*** a scientific Subject and is closer to Psychology.

Logic on Itself is either **philosophical** or **mathematical**, depending on the Focus on either Philosophy or Mathematics [3] .

The Parts of Logic that were the first explained were Statements valued as "true" or "false", their **Inference** and the **quantified Statements**; these gave a Plethora of LogicTypes as well as LogicApplications with the most known the digital Computer.

The **Inference** can be scholarly or scientific. In the **scholarly Inference** you draw your Conclusions by Data that you consider on themselves correct as taken by a religious or non-scientific Source. In **scientific Inference** you draw your Conclusion by Data taken by a scientific Method. Its the scientific Inference that concerns us.

Saying that, when verifying the Validity of non-scientific Sources compared to other non-scientific Sources, the Logic can also be used to compile a Catalog of Statements that validate or invalidate the non-scientific Source. E.g. Comparison of two Liturgical Texts and Verification that either belong to the same Dogma or one belongs to a Sect (the Guys that we will eventually impale!).

Questions and Exercises

1. What is Scholar?
2. What is Scientist?
3. What is Logic?
4. What is scholarly Inference?
5. What is scientific Inference?

[3] At our Times (actually the Effort starts back to the first Computers), an Effort is ongoing to formalize Philosophy with mathematical Methods, See [Steinhart, More precisely The math you need to do philosophy], so that the Reliability and scientific Gravity of Philosophy will approximate to Mathematics. Whether or not this is possible, is in my Opinion not. It doesn't need to be! By introducing Mathematics, you can eliminate Morons from Philosophy, but is still obvious that Science today is surrounded by Idiots and obviously we don't want to replace one Idiot with another: we want to make Science so sacred that the Idiots will not touch it. Some Executions might help in the long Term.

15.1 Logical Proposition

While a Statement in our Context is defined as something with a TruthValue, the Term "Statement" is not so much appropriate of a logical Interpretation; instead, the Term "logical Proposition" is commonly used:

Def. 15.1.0.1*:* **Logical Proposition AKA Proposition:** is called any Statement that can be either true or false.

E.g. "Alex has a Car", says that we assume that a Person called "Alex" has actually a Car, which is a true, and thus a Statement, consequently a Proposition.

E.g. "The Week has seven Days". This is a true Statement, consequently a Proposition.

E.g. "The Moon is a Sun". This is a false Statement, according to the current scientific Definitions and Observations. Consequently this Statement is a Proposition with a false Value.

Propositions are not!:

- Exclamations: e.g. My God!
- Questions: e.g. Do we eat tonight?
- Commands: e.g. Clean your Bed now!
- Incomplete Statements: e.g. Very nice music.
- Ambiguous Sentences: e.g. Maybe I will date you.

Questions and Exercises

1. What is "Statement"? (Repetition from previous Chapters)
2. What is "Proposition"?

3. Find the Propositions (Mark with a "P"-) and Identify Exclamations (E), Questions (Q), Commands (C), incomplete Statements (I) and ambiguous Sentences (A):

   - The Car is red.
   - I failed!
   - Don't mess up with her!
   - Is this true?
   - The Incident is hidden.
   - Perhaps he manages well.

15.2 Premise

A Premise is the required Necessity for Something to happen. By Definition (in General):

Def. 15.2.0.1*:* **Premise (General):** is a the Necessity for Something to happen.

E.g. The Premise for someone to shoot a gun is his Knowledge of the GunActivation.

Premises are used to limit the Capacity for Action, i.e. A Premise is required for an Action to occur. A second Definition on "Premise" will be soon encountered so that we can use it in the Inference.

Question

What is "Premise" in general?

15.3 Conclusion

Conclusion is a Conviction you get after studying a Set of Thoughts. Formally said (but in general):

Def. 15.3.0.1*:* **Conclusion (General):** is an Understanding resulting from the Assessment of Thoughts.

E.g. He draw the Conclusion that she was a Witch, from a Dream he had last Night.

A Conclusion is required after Studying in Order to demonstrate Understanding as well as to form an Opinion. A second Definition on "Conclusion" will be soon encountered so that we can use it in the Inference.

Question

What is "Conclusion" in general?

15.4 Inference

Inference is a Method were we take the **sampled Facts** and based on some **Rules** that describe the **Context** we deduce a **Conclusion** based on the Facts. Here I will keep the Material simplified since a detailfull Treatment of the Subject of Inference is kept in the "mathematical Logic"-Books.

By Definition:

Def. 15.4.0.1*:* **Inference, De. Die Inferenz, Gr. ἡ Ἐπαγωγή, hee Epagoogee:** is the ReasoningMethod where a Set of verified Facts called "Premises" deduce a valid Proposition called "Conclusion" according to Rules of Logic as well as valid Reasoning.

E.g.

- Premise 1: Robert has high Performance in Running.
- Premise 2: "High Performance"-Athletes have good Health.
- Conclusion: Robert has good Health.

Lets assume that the Premises shown are true for a Person called "Robert". In the Inference shown, the two Premises combine their verified Fact and draw a Conclusion about Robert. The Conclusion is drawn under three Conditions:

- We have some Facts. The Facts are formulated to Statements.

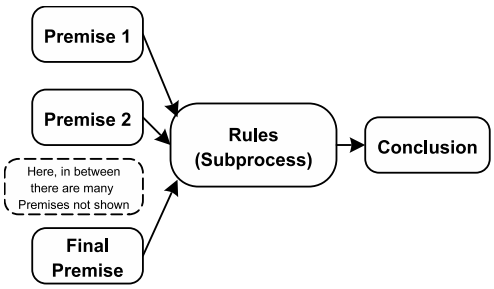


Figure 15.1: The Inference as a Process where Premises are fed to a set of Rules (a Subprocess) and a Conclusion is drawn.

- The Facts have a certain Context that binds them, this Context is Sports and Health.
- The Facts combine and naturally lead to a Conclusion. The Conclusion contains the Facts.

In the Figure 15.1 the Process of Inference is depicted as a System where Premises, related to the the Context, are entered and a Conclusion is drawn. In real Life, the Things can be actually more messy [4] .

To keep our Context, typically you will get a scientific Question in a Form of a Document and some written Resources concerning your Study. Then you will examine the Question, analyze the Resources, define the sets of Rules, derive Premises, and finally either define or validate a Conclusion.

Another Example on Inference, concerning personal Hygiene, is the following:

- Premise 1: I Clean myself meticulously.
- Premise 2: Clean Persons don't get sick due to Dirt.
- Conclusion: It is unlikely that I will get sick due to Dirt.

[4] Similar to looking for a Condom in the dark. You never know if you have can find the Condom or you hold someone's else Item.

Question

What is "Inference"?

15.5 Premises and Conclusion

Having demonstrated the Concept of Inference, I will now limit it to the Definitions of Premise and Conclusion regarding the InferenceProcess.

Scientific Inquiry requires Facts. The Facts, formulated as well-defined Statements, describe the Premises of Inference. Premises require the Facts to be used as Prerequisites for a Conclusion. A Premise is formally defined as:

Def. 15.5.0.1*:* **Premise (Def1):** is a valid Proposition used as a Prerequisite for a valid Argument.

Remark 15.5.0.1. Normally a Premise describes a Fact. However any logical Statement can be a Premise as long as it serves the Context of Inference: even an Absurdity. Here we must to be careful though: that is something allowed does not mean that we can use it.

I denote Premises as "Prex" where "x" is a number. However you can also use Statements if you wish for the Notation of Premises if you signify before that they are used as Statements, i.e. Premises are S1, S2, S3, etc.

You should now understand the Difference of Premise and Cause: a Premise gives a Condition for something to happen, while a Cause makes something to happen. Saying that, Premises validate, via a Set of Rules, a Conclusion. A Conclusion is the Result of the InferenceProcess and I define it as:

Def. 15.5.0.2*:* **Conclusion:** is the Result of logic Reasoning formed in a Statement. [5]

[5] The logic Reasoning is the Part of Inference

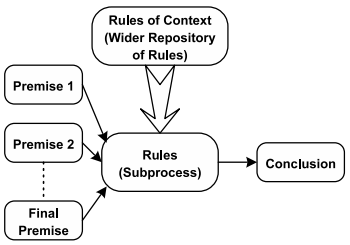


Figure 15.2: Inference drawing Rules from a wider Repository

The Conclusion is inferred (i.e. deduced) from one or more Premises complying to the Rules of the Context, as long as are all true to the Context. The Rules of Context is a greater Group of Rules that contain the Rules of Inference. Because of this, only the most important Rules of Inference are here denoted. See Diagram 15.2.

The **Rules for Inference** typically require that all the Premises are valid. The **Rules of Context** require that the Premises are derived from the required Context. E.g. In this way is absurd to require an Inference on solving a Crime by using the Rules of making a Cake (!).

The Conclusion you can denote it as "Concx", where "x" is a Number or as a Statement "Sx".

Questions

1. What is "Premise"?
2. What is "Conclusion"?

where the Rules are applied to the Premises. Consequently and in this Context, Inference is not logic Reasoning but a wider Process that encloses logic Reasoning.

Chapter 16

Argument and its Parts

Narrative

Inference is used to form Arguments. Obviously for small Sets of Propositions, the Terms "Inference" and "Argument" can be regarded as Synonymous. However and according to my View (Rotten Tomatoes welcome) the Inference is mostly a mental Process concerning small mental Tasks, while the Argument is used for a large mental Task.

An Argument is a set of valid Premises that lead to a valid Conclusion. The Purpose of the Argument is nothing else but either to support or to counter an Opinion.

In this Chapter I discuss some critical Details on Argument and its Validity as well as the Configurations for the Parts of the Argument.

16.1 Validity and Argument

Propositions can be either true or false. A **valid Proposition** is the one that is based on Truth.

E.g. "A Rocket is a FlyingMachine" is a valid Proposition since a Rocket is a Machine that can fly.

The Term "Valid" means based on Truth.

Def. 16.1.0.1*:* **Valid:** based on Truth or on correct Status.

E.g. "His personal Identity is valid", i.e. The person has an Identity that is true.

E.g. "The Message that I received is valid", i.e. A Message has been send that is true, not necessary in Content, but as Message from a trusted Source.

If a Statement is not valid then is "invalid".

E.g. "A Car is a Dragon" is an invalid Proposition since a Car (which is a Machine) is not a living Thing like the Monster "Dragon". (Whether Dragons exists or not is not here the Context. The Context is whether the Car is a living Thing.)

The **PropositionValidity** is the Measure of the **PropositionPlausibility** to actually be part of Reality. The Plausibility that something is true is a great Issue to start an Inference. I.e. if a Proposition says **something absurd for our Time**, e.g. "There is a hybrid of Cat and Book" then the PropositionValidity is false! Clearly we need, when we inspect Propositions, to regard not only the TruthValue but also their Plausibility. Therefore, Validity I define it as:

Def. 16.1.0.2*:* **Validity:** is called the Capacity of being true (aka valid).

However the Term "Valid" is not used so much for Proposition alone but for Sets of Proposition called "Arguments". The Argument describes the Parts of a Thought.

Def. 16.1.0.3*:* **Argument:** is called a Sequence of valid Propositions leading to a

valid Conclusion.

E.g. If this and that then you have a Result.

E.g. If you marry young and have soon Children, you have good Chances that you will see your Grandchildren.

Surprisingly a Proposition can be absurd but still can be used to form an Argument! [1] The Explanation is the following: a well defined Absurdity can be used to create an Argument only when the Absurdity is taken axiomatically, i.e. is regarded as true.

E.g. An absurd Argument about the President.

- Pr1: The President is an Illuminati Lizard.
- Pr2: The Illuminati Lizards hate the Humans.
- Conc: President hate the Humans.

While these Statements are absurd [2] , they are still Propositions which form an Argument. Whether or not the Argument is true, this does not play a Role. What is important is that the Argument is correctly formed.

Consequently the two Criteria for Propositions are:

- The Propositions are either regarded or are valid.
- The Propositions define a valid Conclusion.

Questions

1. What is "Valid"?
2. What is "Validity"?
3. What is "Argument"?
4. Determine which Propositions have Validity: ***TBD***

[1] This is one of "WTF"-Moments.

[2] Perhaps!

16.2 Statements within Inference

In Inference the Facts are described as short and integral Sentences called **"Propositions"**; the Propositions form the Premises for the Inference. However, we can use instead of the Term "Proposition" the Term **"Statement"** without fear of losing Clarity [3] The Propositions are drawn from one or more Media and are written Clearly; if that is not possible, then the Scientist should write equivalent Sentences and test them within his ResearchDuration.

As said, Inference makes heavy Use of Statements, which are Sentences with descriptive Content where each Content has one of two Values, either true (T) or false(F).

E.g. "Hello!" is not a Statement. We cannot have from it a true or false Value.

E.g. "Thomas organizes an End of Semester Party", is a Statement since we can get from it a true of false Value.

Because Statements are Sentences, it will become an Overkill to rewrite the same Sentence over and over [4] . An Abbreviation for a Sentence is appropriate for SentenceReuse, where the Sentence takes an alphabetic Character and a Number.

Statements are denoted as "Sx" where "x" is a Number. To associate a Statement with an alphabetic Character (i.e. a Symbol) use the Form:

$$Sx := StatementSentence. \tag{16.1}$$

[3] Strictly speaking, in mathematical Logic there is a distinction of having a Proposition without an assigned Value (i.e. an Expression) and a Proposition with an assigned Value (i.e. a Statement). This Situation can be very conflicting when someone considers general Science and Mathematics. The Reader as always must to keep his Eyes and Sanity clear on conflicting Words and Definitions, since this is the Area of scientific Endeavor: a dense Forest.

[4] unless you intent to torture Students, which is great!

E.g. S5:=The Neighborhood has high Taxes.

In which the Symbol ":=" has the same Meaning as the SentencePart **"is defined"**.

To display or assign the Value of the Statement use the T and F LogicValues which correspond to "true" or "false".

$$Sx = LogicValue \tag{16.2}$$

In which the Symbol **"="** means the either the Verb "equals" or "assigns".

Def. 16.2.0.1*:* **equals (Logic):** is a Symbol which means that the right and left sided Words or Sentences or Symbols either have the same Meaning or are equal to a Value.

E.g. $S5 = T$. This denotes that the Statement "The Neighborhood FordFlower has high Taxes" is true. However in some Cases you can define that a Statement has a Value if you axiomatically (i.e. you assume) that consider it as having a Value. In this Case you should denote near the Statement the word **"axiomatically"** bounded by Parenthesis.

E.g. S4=F (axiomatically)

Another Issue is the Value of the Statement. The Value of the Statement is called "TruthValue" and can be either true, "T", or false "F".

Def. 16.2.0.2*:* **TruthValue:** is a logical Value describing only Truth or Falsity correspondingly as "T" or "F".

Notice that the Truth or Falsity of a Statement depends on Prerequisites (i.e. Conditions) that we have set for the Statement, i.e. A Fact is a Statement with a true Value, otherwise the Statement is false, i.e. is not a Fact.

Statements that have "false"-Values can also be used in a negated Sense as true Values.

E.g. "Tom is a Liar"=False, tells simple that Tom is not a Liar.

Another Example on TruthValues is the Following: Let a City where we have Information on the Values of Neighborhoods. If we have the named Neighborhoods on a Map *and we know* their TaxationValue, we can separate the Taxation to Values that we consider high and to Values that we consider not high (these might be not low or even unassigned Values). Then the Statement "Neighborhood X with high Taxes" will be true if we know the Statement is true, or false if we know it is false. In the following Table, 16.1 the Values and the Statements for the Neighborhoods are shown.

Neighborhood	Taxation Value	Statement	Statement and known Value
FordFlower	High	S1:=FordFlower has high Taxes	S1=T
DockBridge	Not High	S2:=DockBridge has high Taxes	S2=F
HartValley	Not High	S1:=HartValley has high Taxes	S3=T

Table 16.1: Description of Neighborhoods with TaxationValue and derived Statements with their actual Values

This Example with the Neighborhoods demonstrates the following Concept: when we analyze Information by forming Statements we can test the Statements for Validity and assign TruthValues. The TruthValues are found by analyzing the available Data.

Another Issue of Statements is the StatementLength. You should understand that a Statement should be as short as possible and consequently it is prudent to have less grammatical Elements such as ones that bind Sentences. E.g. The Sentence "If I eat, I won't be hungry" contains two Statements, not one (later I will further explain, move on!).

Questions

1. What is "TruthValue"?

2. What is “equals”?
3. How you denote Assumptions you take? [5]
4. How do you describe Facts with Inference?

16.3 Bibliography

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• [CIA]: Glossary of Intelligence Terms and Definitions. CIA, Langley, Virginia, 1978.

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• [Heard et al]: Jonathan Heard, Claire Scoular, Daniel Duckworth, Dara Ramalingam and Ian Teo. Critical Thinking: Skill Development Framework. The Australian Council for Educational Research Ltd, www.acer.org, 2020.

• [PMI, 2004]: PMI Guide to Project Management body of knowledge 2004.

[5] Answer: Axiomatically

Chapter 17

Introduction to Language

Narrative

The Use of proper Descriptions for a logical Inference is an important Matter. Its Importance is demonstrated in the social Science of Law, where the strict Use of Language determines the Quality of Legislation: good Laws are clear so that no Conflict can arise on their Interpretation by the Citizens [1] .

In this Chapter I give a Glimpse on the social Science of Language from the ViewPoint of logical Inference [2] . The Introduction of Terms serves as a MeltingPoint between the Language used in Logic and Mathematics. The Focus provided is as always the Creation of correct Propositions.

Clarity in Language is more important than ever since the Advent of TextProcessing with Use of artificial Intelligence demands strict Description of the Subject that the User demands. This is particular evident from the View of the User of the Large Language Models used for InformationRetrieval.

I must remind here the unlucky Reader that I don't have any academic Qualification in Linguistics. I provide however a Bibliography for further Reading and Verification. At the End is the Reader of this Book that **must** make this his Study to the Subject I provide; it is an unfortunate Part of modern Life, that the Scientist must know his Trade, even if this involve the Subject of Language, which is typically taught very dry in Schools leading to People that hate Language.

[1] Bad Laws arise when there is more Interpretation than a single Context, giving Rise to Abuse of Law by Swindlers. As Nietzsche put it: too many Interpretations is a Sign of Decadence.

[2] Originally I wanted to have some Introduction on Linguistics! Such a Problem here since Linguistics is not learning a Language but understanding the Mechanisms that a make any Language!

17.1 Language and its hierarchical Structure

Def. 17.1.0.1*:* **Language:** is a CommunicationSystem where Symbols are interchanged between two Parties.

The Communication is done through a Medium acting as a Channel between two Parties where Information flows.

In HumanTerms, Language requires five Items that are configured hierarchically together. These are:

- Symbols
- Words
- Grammar
- Syntax
- Semantics (Meaning)

The Hierarchy is an Aggregation of these Items, where Symbols form Words, Words are reformed according to some

Rules given by Grammar while the Syntax will arrange the reformed Words so that a Meaning is conveyed.

When we consider the Communication between various Systems, is better to discriminate between HumanLanguage and other, "non Human"-Languages.

In the following I speak mostly about HumanLanguage. The Science of HumanLanguage is called Linguistics (formerly known as Philology, from Φιλολογία, ἡ, Friendship of Words, Speech). Linguistics studies the Structure of HumanLanguages as well as their Evolution. The Study of an implemented HumanLanguage is named after the Language itself such as "English", "German", "Mandarin Chinese" [3]

17.2 Symbols and Characters

Def. 17.2.0.1*:* **Symbol:** is an Item that represents a Notion.

In HumanCommunication there are mainly two Categories of Symbols, complex Symbols that convey Notions and phonetic [4] Symbols that convey "Human generated"-Sounds; the latter Symbols are called "Characters" and sometimes "Letters".

Def. 17.2.0.2*:* **Character:** is written Symbol used for the phonetic Representation of Words and Sounds.

Remark 17.2.0.1. Characters are also used for the Representation of mathematical and technical Information.

Characters are two Types in European Languages, these are Vowels and Consonants.

[3] In a FairyTale of Peterson and Findus, a Cat (Findus) asked which was the most delicious Language in the World: Mandarin Chinese!

[4] phonetic is from the ancient Greek φωνή, ἡ, foonée, i.e. Voice.

Def. 17.2.0.3*:* **Vowel:** is a HumanSound produced by the Mouth when the exerted AirFlow is not impeded.

The Vowels are represented in English by the Characters **a, e, i, o , u, y**.

Evolutionary speaking, the Vowels as Sounds were first produced by a Mammal.

Def. 17.2.0.4*:* **Consonant:** is a HumanSound produced by the Mouth when the exerted Airflow is impeded

.

Consonants are short in Duration and are represented in English by the Characters **b, c, d, f, g, h, j, k, l, m, n, p, q, r, s, t, v, w, x, z**.

17.2.1 Readable Characters

The original CharacterSet used in English Language is based on the Latin CharacterSet also known as "Antiqua" (read this as "Antika"). The Antiqua originated in Greece, and was more common to the (Euboia) Alphabet than the Ionian which is The Greek Alphabet, i.e. the Alphabet that persisted through Time. Some Diversions of the Antiqua Alphabet came with the Runic Alphabet which originated in North Italy, but didn't last long. Another Diversion came from the Jewish Culture, in particular with the so called "Fraktur" Alphabets that originated by Swabian Jews in the Middle Ages; eventually the Antiqua came again in its Form, with the last Bastion of Fraktur, Germany, abolishing it 1941 but sadly it didn't return after 1945. The Greek Alphabets are in 17.1.

"Fraktur"-Font (UniFrakturMaguntia) is shown inf Figure 17.2:

There are five Methods to write an Characters on Paper:

- **The Script**: this is HandWriting, that resembles printed Text. Source: [Bateman].
- **The calligraphic Writing**; this is the Handwriting that uses aesthetic

Euboea	Ionië	Athene	Korinthe	modern
A	AA	AA	AA	A
B	B	B	⅄Π	B
ᚲᚳ	Γ	Λ	ᚲᚳ	Γ
ᐅᐅ	Δ	Δ	Δ	Δ
ᛕE	ᛕE	ᛕE	ᛒ	E
ᚹ	-	ᚹ	ᚹ	(F)
I	I	I	I	Z
⊟H	⊟H	⊟H	⊟H	H
⊗⊕⊙	⊗⊕⊙	⊗⊕⊙	⊗⊕⊙	Θ
I	I	I	I	I
K	K	K	K	K
ᒪ	ᛚᐱ	ᒪ	ᛚᐱ	Λ
ᛖᛖM	ᛖM	ᛖM	ᛖM	M
ᛖN	ᛖN	ᛖN	ᛖN	N
X	⨪	(Xᔑ)	⨪	Ξ
O	O	O	O	O
ᒥᒥ	ᒥ	ᒥ	ᒥ	Π
ᛗ	-	-	ᛗ	(M)
Ϙ	Ϙ	Ϙ	Ϙ	(Ϙ)
P	P D	P R	P R	P
ᔑ	ᔓ	ᔑ	-	Σ
T	T	T	T	T
ᚴᛉᚸ	ᛉᚸ	ᚴᛉᚸ	ᚴᛉᚸ	Y
Φ Φ	Φ	Φ Φ	Φ Φ	Φ
ᛉᛘ	X	X	X	X
(Φᔑ)	ᛉᛘ	(Φᔑ)	ᛉᛘ	Ψ
-	Ω	-	-	Ω

Figure 17.1: The most common Greek Alphabets. Attribution: By **BishkekRocks** - Self made. Based on **Bildatlas der Sprachen, Augsburg 1998**. The fonts used are Arial and etruscotutto by James F. Patterson ([1])., CC BY-SA 3.0, `https://commons.wikimedia.org/w/index.php?curid=1527408`

Aspects to make the Writing an appealing Experience and artistic Artifact.

- **The Lettering**: this is the Handwriting that is an artistic Discipline dealing with Presentation. It is used for Epigraphy.
- **The rapid Hand AKA Longhand**: this is the Handwriting for quick Writing and uses calligraphic Elements of reduced aesthetic Value but . See [Zaner]
- **The Shorthand AKA Stenography**: this is the Handwriting used for rapid Writing to copy a Speech or Conversation. It follows in Speed the HumanSpeech (!).

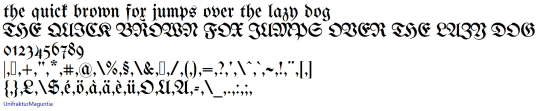


Figure 17.2: The Fraktur UniFraktur-Maguntia. According to the Distribution: UnifrakturMaguntia has been created by **j. 'mach' wust, Gerrit Ansmann and Georg Duffner**. You can reach us at: `http://unifraktur.sf.net/unifraktur-forum/` . UnifrakturMaguntia is a modification of Peter Wiegel's font **Berthold Mainzer Fraktur** that can be found at the following site (retrieved 2010-03-14) and that is in turn based on a 1901 typeface by **Carl Albert Fahrenwaldt**: `http://www.peter-wiegel.de/KochFraktur.html`

The Writing imposes two Problems to the Reader, the Problem of correct Writing and the Problem of CharacterInterpretation during Reading. For these Problems various Alphabets have been created through the Years.

The following Alphabet is the Longhand Alphabet, that was used in Swiss Schools until 2016, the Schnuerli. See 17.3.

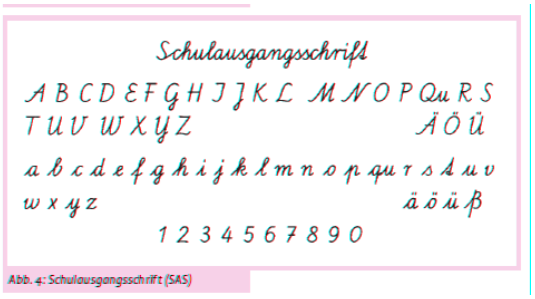

Schulausgangsschrift
A B C D E F G H I J K L M N O P Qu R S
T U V W X Y Z Ä Ö Ü
a b c d e f g h i j k l m n o p qu r s t u v
w x y z ä ö ü ß
1 2 3 4 5 6 7 8 9 0
Abb. 4: Schulausgangsschrift (SAS)

Figure 17.3: The Schnuerli or Schulausgangsschift. Source: GS aktuell 91, September 2005.

In digital Publications, the Printing-Types, i.e. the MetalComponents representing Characters (these imprint Inc on Paper) became the Fonts. However not all

Fonts are equal! Readers, not only neurodivergent Readers, have ReadabilityDisadvantages that can impede the Reading. See [Herrmann].

A Series that I produced [5] of problematic Characters are the Sets:

- x, k
- y, g
- X, H
- 5, S
- C, G, 6
- A, R
- 0, O, Q
- i, I, l, L, 1, 7, j, J
- 9, g, q
- 2, Z

Remember that also the Longhand can create Problems in the CharacterDepiction! Winners for Fonts are Liberation Mono, developed by Steven Matteson for the Ascender Corporation©which is good form most DataSets and Roboto Mono which is not for all DataSets. In addition, the Font "Monaco" from Apple©makes outstanding Job as CodingFont for "ComputerProgramming"-Languages. I have also include the Arial and Times New Roman, both from Monotype Corporation©and both distributed from Microsoft©.

The Pangram, i.e. the whole Alphabet depicted in a Phrase used for FontDepiction ("The Quick brown fox jumps over the lazy dog") Microsoft™Use. The Software for the Description of the Fonts was "PrintMyFonts" from Stefan Trost Media©, sttmedia.com and it was used non commercially for this Book. Please support Stefan Trost Media©. I have also included some Forms of German Characters, the Ones with "Umlaut" but not the Ones with "Eszet".

[5] Some of these are encountered in similar ResearchEfforts, see [Herrmann]

17.3 Words and Syllables

Def. 17.3.0.1*:* **Word:** is an Aggregation of either Characters or Sounds and represents the actual Sound of a spoken Notion.

E.g. when you say the Word "Computer" you describe an Item with the identical Functionality as the Definition you have in your Memory about the Object "Computer". However when you write the Word "Computer", you use a carefully placed Aggregation of Characters that reproduce the Word phonetically: "COMPU-TER".

Written Words are represented by Characters and can be broken into Syllables.

Def. 17.3.0.2*:* **Syllable:** is a separate Part of a Word that typically in its most primitive Form, contains a Vowel and a Consonant together.

Every spoken Language has its own Rules for the Decomposition of a Word into Syllables, a Subject that I will not mention.

17.4 Grammar and Syntax

Def. 17.4.0.1*:* **Grammar:** is the Study of Words and their Formation according to Rules local to a HumanLanguage.

E.g. How the Word "do", changes with regard to Time, (do, did, done), or with regard to the Person using it (I do, you do, he does, we do, you do, they do).

Def. 17.4.0.2*:* **Sentence:** is an WordsAggregation intended to describe a clear Meaning.

[6]

A Sentence is either separated by a Comma ","- or a Period "." . E.g.

[6] Sentence trace its Etymology in the Latin Word "Sententia" which has the Meaning "Thought"[Nesfield], [Skeat].

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,¦,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Arial

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,¦,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Liberation Mono

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,¦,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Liberation Sans

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,¦,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Liberation Serif

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,□,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Monaco

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,¦,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Roboto Mono Regular

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789,
the quick brown fox jumps over the lazy dog
0123456789
|,¦,+,",*,#,@,\%,§,\&,¬,/,(,),=,?,',\^,`,~,!,¨,[,]
{,},£,\$,é,ö,à,ä,è,ü,Ö,Ü,Ä,-,_,.,:,;,
Times New Roman

Figure 17.4: FontDescriptions, see Text.

The Sentence “Scientists found the Cure of Dyslexia” conveys a clear Meaning, while the Sentence “’Dyslexia Scientists the Cure found” is meaningless (though if you suffer from Dyslexia perhaps has a Meaning) [7] .

Def. 17.4.0.3*:* **Syntax:** is the Study of the WordPlacement in Sentences according to Rules of Meaning.

E.g. “I am going to play Football” is a Sentence that conveys clear Meaning by first placing the Character “I” to denote a Person, then the Verb “am going” in the second Position and another Verb “to play” to denote an Action affecting an Object called “Football”.

Def. 17.4.0.4*:* **Paragraph:** is a Group of Sentences that describe a Context.

Def. 17.4.0.5*:* **Context (Grammar):** is a described Situation where the Sentences logically belong.

The Paragraph has a BeginningSentence, a Body and an EndingSentence.

Returning to Sentences, a Phrase is a Part of a Sentence, i.e, a Phrase is a WordsGroup.
Def. 17.4.0.6*:* **Phrase:** is a SentencePart.

17.5 Semantics

Language is used for InformationInterchange where Meaning is conveyed through Words and Sentences.
Def. 17.5.0.1*:* **Meaning:** is called the Representation of Knowledge in a Sentence or Word or Notion.

Meaning is Studied by Semantics according to a HumanLanguage at Hand.

Def. 17.5.0.2*:* **Semantics:** is the Study of the Meaning in a Language.

[7] This is an Example taken from the MotionPicture “Naked Gun 3”.

Remark 17.5.0.1. Though a Language is a CommunicationMean between two Parties, technological Progress has created Computers that need to Communicate with Humans. Consequently the Semantics were redefined in the most primitive Form to include the Aspect of ProgrammingLanguages.

However the Meaning might not necessary convey the true Meaning that the Speaker (or Writer) intended. E.g. the Sentence “Paris was liberated from the Germans” has two Meanings: either Paris was freed from the Germans (i.e. the Germans were Occupiers) or Paris was freed by the Germans (i.e. the Germans were the Liberators); here the political Orientation of the Speaker remains unknown (is he anti German or pro German?) [8] . This Fluidity in Language is used very much in legal Contracts, Law and Swindle [9] . Despite the Idea of *common Sense*, common Sense is not common!

17.6 Grammatical Subject and grammatical Object

The Terms “Subject” and “Object” are somewhat confused in Grammar since their Use interfere with the similar Words of everyday Life that I have already defined. In order to make the Things simpler, whenever I speak of Syntax, I use the Description “grammatical” near the Words “Subject” and “Object”.

Def. 17.6.0.1*:* **Grammatical Subject:** is the Word that describes a Performer or Recipient of an Action.

[8] Use of Language requires at least some Intelligence. In the particular Sentence a trained Individual will discriminate based on his Experience that the Word “from” refers to a Causation. However other People might not.

[9] Which reminds me the Joke of how to put an Attorney down from a Tree: you cut the Rope.

Remark 17.6.0.1. The Grammatical Subject can be a Name, Animal, Person, Notion or Thing.

E.g. "Chris went for a Walk" has grammatical Subject the Name "Chris".

Def. 17.6.0.2*:* **Grammatical Object:** is the Word that describes something affected by an Action introduced by the grammatical Subject.

E.g. "Chris went for Shopping", has grammatical Object the Notion "Shopping".

Questions and Exercises

1. What is Subject?
2. Identify the Subjects in the Sentences. ***TBD***
3. What is Object?
4. Identify the Objects in the Sentences. ***TBD***

17.7 Punctuation

When we compose a Sentence, we can add some special Symbols, called "Punctuators" AKA "PunctuationSigns" to denote Pause of various Durations, implied Meaning, Emotion etc. By Definition:

Def. 17.7.0.1*:* **Punctuation:** is the logical Division of a Sentence to SentenceElements

According to [Nesfield] [10] the Punctuators in English (enclosed in single Quotes) are:

- The Comma: ','
- The Semicolon: ';'
- The Colon: ':'
- The Period AKA full stop: '.'
- QuestionMark AKA Note of Interrogation: '?'
- Apostrophe: ''''
- ExclamationSign AKA Note of Exclamation: '!'
- The four Brackets:
  - Parenthesis: '(', ')'
  - SquareBrackets: '[', ']'
  - Curly Braces: '', ''
  - AngleBrackets: '¡', '¿'
- Dash:
- Hyphen:
- Single Quotes: ' ' '
- Double Quotes: ' " '
- Bullet: '•'

The Comma, ',', is a short Pause. E.g. "He spoke to the Kid, the Kid answered." Here the Comma induces a Pause that I perceive as occurring in half a Second.

The Semicolon, ';', separates and denotes Propositions and in Duration is longer than Comma.

The Colon, ':', introduces a Remark concerning the mentioned Proposition. It resembles a Halt, where you stop to to explain something until the Proposition is fully explained.

The Period, '.', terminates the Sentence. It has the double Duration of Comma.

The QuestionMark, '?', denotes that the Sentence is a Question and consequently should be said in an interrogative Mode.

The Apostrophe, ''', is used in either Contraction, e.g. **do not** becomes **don't** or Possession, e.g. **The Guide of the Player** becomes **Player's Guide**. In some Cases for the Building of Plural, e.g. The Girlsfriend's.

[10] I did augmented his Text in this Section, since it is outdated.

The Dash, '–', introduces Abruption within a Sentence. It is longer than Hyphen.

The Hyphen, '-', divides two Words or Syllables. I use them for separating a Noun into either quoted or phrasal Parts, e.g. The "Datum"-File, the "secret Customer"-Present. The Hyphen is shorter than Dash.

The single and double Quotes, ' ' '. separate the Quotation within a Sentence.

The Bullet, '•' is used for "non numerated"-Lists.

17.8 Lists

A List is a Set of Words that are one typically one under the other and and lay a Set of Items either as Categorized or as Decomposed from another Item.

Def. 17.8.0.1*:* **List (Publishing):** is a Set of Items that are visually separated for easy Categorization or Decomposition by the Reader.

A List can be indicated by large Dots called "Bullets" or can be Numbered. Advances in Printing allow actually any Symbol to be used instead of Dots to cover the Demands of even the most perverse Minds: the ones of Attorneys! (Ha! Ha!)

For listing independent Items, we use "Bullets". Decomposing "bulleted" Items we use any other Symbol included empty Bullets, Caro (Diamond), Heart etc. i.e. • ○ ◇♡

For listing hierarchically decomposed Items, there are many Views, first a Number, the decomposed Member be a Character and the further decomposed member be a Latin Number. I call this Scheme "1ai", as "OneAI" and it concerns Lists such as 1.a.i, 1.a. ii, 1.b.i, 3.d.iv etc. Alternatives could be according to my Notation "OneIA", "IOneA". [11]

[11] Since many People will use Microsoft™Word™for their Documentation, in the Version 2003 the Notation is "OneAI". I used to be hard User of Microsoft™Word™, which I still respect.

E.g. A List of independent Items:

- Coal
- Tree
- Car
- Paint Equipment
  - Paintbrush
  - Colorant
  - Solvent
  - DustRemover
  - HandGloves

E.g. A DecompositionList

1. Car
   (a) Wheels
   (b) Structure
   (c) Engine
   (d) FuelTank
   (e) Controls
      i. SteeringWheel
      ii. Switches
      iii. Gauges
      iv. Radio
      v. NavigationElectronics

17.8.1 Bibliography

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- [Hewigs]: Martin Hewigs, Advanced grammar in Use Cambridge University Press 1999 Cambridge UK
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- [Zaner]: Zaner, C.P. The Arm movement method of rapid writing. Zaner and Bloser, New York, USA, 1904.

17.8.1.1 Suggested Readings

If you need to write correctly you need Books on the Subject of technical and creative Writing. I have here included a List of suggested Books. The Books include A Grammar as well as Books on Writing, both in technical and creative Domain.

17.8.1.1.1 EnglishResources

- [Murphy]: Murphy, Raymond. English grammar in use. Cambridge University Press, Cambridge, UK, 2005.
- [Mamishev et al]: Mamishev et al. Creating research and scientific documents using Microsoft Word. Microsoft Press, Redmond, Washington, USA, 2013. Note from Neufelt: This is actually a good Book! However, I prefer to work with Latex, since there are always hidden Mechanisms in Software that sabotage the Editing of Documents. Microsoft Word©is a great Software, but it has also Limits.
- [Alred et al]: Alred et al. The handbook of technical writing. Bedford/St. Martin's, Boston, MA, USA, 2012.
- [Ritter]: Ritter. The Oxford guide to style. Oxford University Press, 2002.

17.8.1.1.2 GermanResources

- [Locher et al]: Locher et al. Schreibweisungen. Schweizer Eidgenossenschaft, Bern, Bern, Schweiz, 2015.
- [Juhl]: Juhl, Dietrich. Technische Dokumentation Praktische Anleitungen und Beispiele. Springer, VDI, Berlin, Deutschland, 2005.

Chapter 18

The Parts of Speech

18.1 Parts of Speech

Words are also divided into Parts, which are the Following for English:

- Nouns
- Pronouns
- Articles
- Adjectives
- Verbs
- Prepositions
- Adverbs
- Conjunctions
- Particles
- Interjections

The Amount of these Parts is bounded by the HumanLanguage in Use. A short Introduction to them comes next.

18.2 Nouns

Def. 18.2.0.1*:* **Noun:** is a Word that names either a Notion, an Animal or Thing or a Name.

E.g. the Words "Cow", "Knife", "Salesman", "Jim"- "Anger" are all Nouns.

Sometimes instead of a Noun, a NounPhrase is used.

Def. 18.2.0.2*:* **NounPhrase:** is either an Aggregation of Nouns or a Phrase used as a Noun.

E.g. "The Woman next Door is cooking"-, has the NounPhrase "Woman next Door". E.g. "The Duty Officer is performing a Control" has NounPhrase "Duty Officer".

Questions and Exercises

1. What is a Noun?
2. Underlines the Nouns in the following Sentences: ***TBD***
3. What is a NounPhrase?
4. Underlines the NounPhrases in the following Sentences: ***TBD***

18.3 Pronouns

Def. 18.3.0.1*:* **Pronoun:** is a Word used as a Replacement of either a Noun or NounPhrase.

The Pronoun has the Characteristic that serves as an anonymous Noun that is used repeatedly for a named Noun. E.g The Sentences "Jim is so mad. He wrote Notes all over the place; then he censored all his Notes with a black Pen." name the Noun "Jim" and repeatedly replace it with the Pronoun "He".

There are many Types of Pronouns. Two Types are the **Subject-** and the **ObjectPronoun**. The SubjectPronouns are "I, you, he, she, it, we, you, they". The ObjectPronouns are "me, you, her, him, it, us, you, them".

Beyond these Pronouns specific Categories of Pronouns are:

- *Def.* 18.3.0.2*:* **Reflexive Pronouns:** these reflect to the Action of a Person that is mentioned. In English are: "myself, yourself, himself, herself, itself, ourselves, yourselves, themselves".

- *Def.* 18.3.0.3*:* **Demonstrative Pronouns:** these indicate an Item. In English are: "this, that, these, those".

- *Def.* 18.3.0.4*:* **Possessive Pronouns:** these indicate Possession. In English are: "mine, yours, his, hers, its, ours, yours, theirs".

- *Def.* 18.3.0.5*:* **Interrogative Pronouns:** These indicate Questions. In English are: "what, where, when, which, how, who, whom, whose, why".

  [1] .

- *Def.* 18.3.0.6*:* **Relative Pronouns:** these refer back to the Person that is mentioned. In English are:"that, which, who, whom, whose", e.g. "The Man who cheated his Wife".

[1] The Order of Appearance of these Pronouns was learned meticulously from Journalists, Researchers, Investigators and Interrogators (Hit me Baby!) for the Description of an Event: What happened? Where happened? When happened? Which Items acted? How it happened? Who was acting and acted upon? Whom may concern? Whose Responsibility? Why did it happened? It is very interesting the Questions that can arise from a Group of Pronouns.

Questions and Exercises

Please make these Exercises slowly, one Type of Pronoun each Time. You learn to Identify in this Book, not every Detail.

1. What is Pronoun?
2. What are the Types of Pronouns?
3. Identify the Types of Pronouns in the Sentences as (S)ubjectPronoun and (O)bjectPronoun. ***TBD*** .
4. What is a reflexive Pronoun?
5. Identify the reflexive Pronouns in the Sentences ***TBD*** .
6. What is a demonstrative Pronoun?
7. Identify the demonstrative Pronouns in the Sentences ***TBD*** .
8. What is a possessive Pronoun?
9. Identify the possessive Pronouns in the Sentences ***TBD*** .
10. What is a interrogative Pronoun?
11. Identify the interrogative Pronouns in the Sentences ***TBD*** .
12. What is a relative Pronoun?
13. Identify the relative Pronouns in the Sentences ***TBD*** .
14. Identify the all Pronouns in the Sentences and signify (S)ubjectPronoun and (O)bjectPronoun followed by re(f)lexive (d)emonstrative, (p)ossesive and (r)elative, e.g. sr means relative SubjecPronoun. ***TBD*** .

18.4 Articles

Def. 18.4.0.1*:* **Article:** is a Word that describes a Noun in either a definite or indefinite Fashion.

E.g. See the Dialog:

"I want to speak to a Jim"

"Which Jim? We have many Jims in this WorkShop"

"I want to speak to The Jim".

The Phrase "a Jim" has the indefinite Article "a" which means by Context "someone". The Phrase "The Jim" has the definite Article "The" which means by Context a specific Person; notice that the capital "T" was used to denote the Stress on the Part of the Sentence.

There are two Types of Articles in English, the **definite Article "the"** and the **indefinite Articles "a" and "an"**.

Questions and Exercises

1. What is Article?
2. Find the definite and indefinite Articles in the Sentences ***TBD***

18.5 Adjectives

Def. 18.5.0.1*:* **Adjective:** is a Word that describes either a Noun or a Pronoun where the Description of the Adjective stems from the Attachment of a Property into the Noun or Pronoun.

E.g. "The beautiful Man" has the Adjective "beautiful" attached to the Noun "Man" and describes that the Noun "Man" has the Property of being "beautiful".

There are many Adjectives for every Occasion and consequently a List of them will be Pages long to mention.

Unknown Technologies or Attributes can be further investigated by Use of AdjectivesLists where the Adjectives are queried regarding to their Correspondence to an Aspect of the Investigation. An Example of this is the Tests of Taste: a Product is tasted by Professionals and they look at the 5 Aspects of Taste (Bitter, Sweet, Salty, Sour, Omame (Cheese, Meat and Yeast)) and then they search for the hidden Vectors of Aromas such as Nut, Floral, Fruity etc. Note that the Nouns I use are also Adjectives.

Questions and Exercises

1. What is Adjective?
2. Identify the Adjectives in the following Sentences. ***TBD*** .

18.6 Verbs

Def. 18.6.0.1*:* **Verb:** is a Word that describes either the Action or passive State or Condition of a Noun or Phrasal Noun.

E.g. "Jim answers the Phone" has the Verb "answers" and describes an Action.

E.g. "The Man was killed by the Criminal" has the Verb "was killed" and describes a passive State.

E.g. "The Child sleeps" has the Verb "sleeps" to describe that the Child is in the Condition of Sleep.

The **Infinitive** is the most basic Form of the Verb and is used a Verb together with the Subject. However the Subject can modify the Verb.

E.g. "I call" has the Verb "call" in its Infinitive.

E.g. "He calls" has the Verb "call" modified.

Def. 18.6.0.2*:* **Infinitive:** is the main Form of the Verb.

Verbs have two Dimensions (Directions), one is **temporal** and the other concerns the **ActionType**.

The **temporal Dimension** concerns Time and allows the Verb to be allocated to a particular TimePoint; the TimePoints are three, namely the Past, the Present and the Future.

The **Dimension of ActionType** (AKA Aspect) concerns the Fashion of the VerbAction; there are three Fashions, a continuous, a simple and a perfect. The "continuous" means that the Noun acts continuously (or at least an Action is ongoing), e.g. "Jim is running" means that Jim runs now without End, i.e. continuously. The "simple" means that the Noun acts one Time, e.g. "Jim hits the Ball" means that Jim just hit the Ball and that's it. A "perfect" is not what it means; this Word comes from Latin and means completed [2] , that is, the Noun has completed the Action. E.g. "He has closed the Computer", means that a Person closes something and his Action is ended right there.

The two Dimensions of Verbs are shown next. Worth to know that each deployment of a Verb to a specific Case, is called "Tense". The Dimensions of Verbs is here a Refitting that I did from an original Source [Triantafillides, Neoellineki Grammatike for Greek schools, Reedit in 1982 based on 1941 Edition]; I haven't found any equivalent Diagram in English or German Literature, and I suspect that such a Diagram was from French Literature where Triantafillides was Familiar. See Table 18.1 for the Tenses and their Position.

You must understand a fundamental Detail on these two Dimensions of Verbs: not all Languages implement the Cases for each Tense! This is because a HumanLanguage develops differently due to Location, Circumstance and Genetics, to name a few Factors.

Another Issue that I have to mention is that the Verbs have regular and irregular TimeForms which correspond to Present, Past and Perfect (actually this is a "past Participle"-), i.e. the TimeForms for the regular Verb "cut" are: "cut", "cut", "cut" as in e.g "I cut the Tree"-, "I cut the Tree this Morning"-, "The Tree was cut". However the irregular Verbs have irregular Timeforms, i.e. the TimeForms for the irregular Verb "freeze" are "freeze", "froze", "frozen" e.g. "I freeze right now", "I froze yesterday", "The meat is frozen".

Finally the **Grammatical Moods** are VerbForms that are used in declarative, interrogative, imperative Sentences as well as Sentences used to show Exclamation.

Def. 18.6.0.3*:* **Grammatical Mood, Gr. ἔγκλησις, ἡ, De. Modus:** is called the VerbForm used for signifying the Modality of the Action.

Def. 18.6.0.4*:* **Modality:** is called the Distinction in performing an Action.

E.g. You can perform a Murder with either "in cold" or by singing, i.e. with different Modalities.

There are three grammatical Moods in English Language:

- *Def.* 18.6.0.5*:* **Indicative Mood:** is the grammatical Mood that indicates a Fact.

  E.g. I pray to Gods

- *Def.* 18.6.0.6*:* **Subjunctive Mood:** is the grammatical Mood that indicates either a Desire or an Expectation.

  E.g. If I prayed to Gods, then...

- *Def.* 18.6.0.7*:* **Imperative Mood:** is the grammatical Mood that indicates a commanding Action.

  E.g. Pray to Gods!

In the Programming of ComputerLanguages, many Commands are in the imperative Mood. E.g. "print". Having this Information, the following Program (written

[2] This is direct Translation of the Romans from the ancient Greeks which named this Fashion as "fully ended"-, i.e. τετελεσμένος, tetelesménos.

Aspects and Time-Points	Past	Present	Future
Continuous Action	**Past continuous** e.g. "I was writing"	**Present continuous** e.g. "I am writing"	**Present continuous** e.g. "I am writing Exams next Week" **Future continuous** e.g. "I will be writing at 10:00"
Simple Action	**Past simple** e.g. "I wrote"	**Present simple** e.g. "I write"	**Present simple** e.g. "I write Exams at 10:00" **Future simple** with "will" and "shall" e.g. "I will write at 10:00"
Completed Action (continuously)	**Past perfect (continuous)** e.g. "I had been writing"	**Present perfect (continuous)** e.g. "I have been writing"	**Future perfect (continuous)** e.g. "I will be writing at 10:00"
Completed Action (simple)	**Past perfect (simple)** e.g. "I had written"	**Present perfect (simple)** e.g. "I have written"	**Future perfect (simple)** e.g. "I will have written"

Figure 18.1: The two Dimensions of Verbs and the associated Tenses

in BASIC) displays the Message "Enter a Number", then assigns the Value to something called "A", then displays the Value that is within "A", and finally stops. All the Words, "PRINT", "INPUT", "END" are Verbs of imperative Mood.

```
PRINT "Enter a Number:"
INPUT A
PRINT A; "You entered: ";
END
```

Questions and Exercises

1. What is Verb?
2. What is Infinitive?
3. What are the two Dimensions of Verbs?
4. What is grammatical Mood?
5. What is indicative Mood? Give an Example
6. What is subjunctive Mood? Give an Example
7. What is imperative Mood? Give an Example

18.7 The Preposition

[3]

Def. 18.7.0.1*:* **Preposition:** is called a Word that describes either Time or Location or Direction before a Noun or Noun-Phrase.

[4]

[3] For the Dyslexics like my self, (i.e. Dyslexics the for my self like), the Word "Preposition" shouldn't be confused with the Word "Proposition", since one is a Word used for Construction of Sentences, e.g. "I am logged IN Porn Hub ", while the other denotes a SentencePart with a true or false Content, e.g. "The Website of WH sucks" (true).

[4] Here I broke the Rule of Dr. Nesfield (see Page 10, Note 1 on Prepositions, on his Book Manual of English Grammar). It still however a good Definition for my unique View. Funnily

E.g. "The Cloths are on the WashingMachine" has the Preposition "on" to describe the Location of the Cloths with regard to the NounPhrase "the WashingMachine".

E.g. TimePreposition: "At about an Hour I will come": "about" is a TimePreposition.

E.g. LocationPreposition: "The Book I have left between the Clothes": "between" is a LocationPreposition.

E.g. DirectionPreposition: "He runs towards the Field": "towards" is a DirectionPreposition.

Remark 18.7.0.1. Some Prepositions can describe one or many Aspects, such as Time and Location etc. Consequently its the Context of Sentence which reveals the Aspect in Action.

E.g. TimePreposition: "The Train will arrive on Time": "on" is a TimePreposition.

E.g. LocationPreposition: "I have left the Book on the Table": "on" is a LocationPreposition.

The following are Prepositions: about, above, across, after, against, along, among, around, at, before, behind, beneath, beside, between, beyond, by, despite, down, during, for, from, in, into, like, near, nigh, of, off, on, onto, out, over, since, through, throughout, till, to, toward, under, until, up, upon, with, within, without.

The following Prepositions consists of more than on Word: according to, ahead of, as far as, back of, because of, by means of, contrary to, in addition to, in front of, in place of, in spite of, instead of [Schaffer et al].

enough, my Definition was written before I read his Definition and notice their Similarity; almost Identical. This should be a Warning on your Material; you might provide the identical Result with somebody else leading to a Conflict (his Work is older than mine!). Thus you should check your Work to avoid any Accusation of Plagiarism.

Questions and Exercises

1. What is Preposition?
2. Identify the Propositions in the Sentences: ***TBD***

18.8 The Adverb

Def. 18.8.0.1*:* **Adverb:** is a Word that describes either a Verb or an Adjective or a Preposition or a Conjunction or another Adverb in the Aspects of Frequency, Location, Modality, Time and Quantity.

E.g. "He manages well". The Adverb is "well".

E.g. "They placed early the Orders". The Adverb is "early".

E.g. "He went very exhausted to the Public Office". The Adverb is "Very".

Remark 18.8.0.1. Obviously the Adverb is the Equivalent to the Adjective concerning the Enhancement of Description. However the Manner of the Description concerns very intimate Aspects of the described Word.

E.g. Compare "He answered" with "He answered carefully".

The Adverbs are identified as three Groups, namely

- Adverbs ending in "ly", such as "softly", "brutally", "democratically". These might as well be derived by Adjectives, such as "beautiful" makes "beautifully".
- Adverbs with irregular Endings, such as "well", "almost", etc.
- Adverbs that are actually Nouns (Adverbial Objectives [Schaffer et al]), such as "After the game he went home", with "home" the Adverbial Objective [Schaffer et al].

Another Aspect of the Adverbs is that they answer to Questions such as: “Where?” (Location), “When?” (Time), “How?” (Modality), “How much?” (Quantity), “How often?” (Frequency). Consequently these AdverbDescriptions are divided as:

- Local Adverbs: Here, there, away, near, up, down etc.
- Temporal Adverbs: now, soon, then, daily, timely etc.
- FrequencyAdverbs: never, rarely, sometimes, often, always etc.
- ModalityAdverbs (Adverbs of Manner): badly, sarcastically, quietly, swiftly etc.
- QuantityAdverbs: very, too, enough, almost, just etc.

Questions and Exercises

1. What is Adverb?
2. State the Aspects that the Adverbs describe. ***TBD***
3. Identify the Adverbs. ***TBD***

18.9 Conjunctions

Def. 18.9.0.1*:* **Conjunction:** is a Word that connects other Words for the Purpose of complementing the Context.

E.g. “I cleaned the Room and the Bath”: the Word “and” is a Conjunction.

E.g. “I clean the Rooms but the Bath”: the Word “but” is a Conjunction.

While the Conjunctions seem easy to Use, their Meaning can be especially confusing if the Context is not clear.

E.g. the Conjunction “or” can be used inclusively (i.e. one or the other or both) or exclusively (i.e. one or the other but not both). E.g. 1 I want this Cake or the other Cake. E.g.2 I want to pilot a Ship or an Aircraft. While both Sentences are used exclusively, there might be Misinterpretation of the first Sentence to *infer* both Cakes. A Solution adopted in this Book is the one of “either...or” where it emphasizes the exclusive Nature of “or”.

Conjunctions are divided into three Groups:

- *Def.* 18.9.0.2*:* **Coordinating Conjunctions:** are Conjunctions concerning two Words of the same Type.

  These are “and”, “for”, “but”, “or” etc. E.g. “Tim and Struppi”.
- *Def.* 18.9.0.3*:* **Correlative Conjunctions:** are Conjunctions that correlate two Words.

  These are “if...then”,“ both...and”, “either...or”, “neither...or” etc. E.g. “Neither Tina or Mary” (they are ugly anyway).
- *Def.* 18.9.0.4*:* **Subordinating Conjunctions:** are Conjunctions that bind to the same Context two Sentences.

  These are “even though”, “once”, “when”, “until” etc. E.g. I will wait until the dawn comes.

Questions and Exercises

1. What is Conjunction?
2. State the three types of Conjunctions.
3. What is the Problem with “or” and how “either...or” solves it?
4. Identify the Conjunctions in the Sentences. ***TBD***

18.10 Particles

A Particle is an added Word within a Sentence that modifies the Meaning.

Def. 18.10.0.1*:* **Particle (Grammar):** is a Word within a Sentence that modifies the Meaning and is mostly associated with a Verb which becomes with the Particle a "phrasal Verb".

E.g. "He was fucked down with this Job". The Particle is "down" and modifies the Verb "fuck" in the Sense of Submission.

Particles are "up, down, in, out" etc.

Questions and Exercises

1. What is Particle?

18.11 Interjections

Def. 18.11.0.1*:* **Interjection:** is a Word used to express a sudden, short Emotion.

E.g. "Ouch! Who the Fuck let Lego's on the Floor?" (Real Problem if you are a Parent).

E.g. "Oh! I never thought you were castrated!" (Real Problem within the Gay-Community. I feel you Guys!).

The Interjection expresses Emotions such as (among others): Admiration (Whoa!), Pain (Ouch!), Sadness (alas), Disgust (Uh um! [5]), Fear (Aah!), Acclamation (Hurrah), Surprise (Oh!).

Questions and Exercises

1. What is Interjection?
2. Name some Feelings and their Interjections.
3. Identify the Interjections in the Sentences.

[5] E.g. Uh um! Don't do this, you will not kill him like that.

Chapter 19

The Sentences

Narrative

In this Part I will provide only Glimpse into the **vast** Subject of Syntax. This is the Subject that most People make Divergions called "Errors", since all of People diverge more a less from a Set of imposed Rules, in this Case, the GrammarRules. The whole Idea here is not to make a Course, but to define some standard Ways the Sentences are organized so that I can create a Framework for logical Inference.

I try to give a hierarchical View of the Subject, avoiding the Views that we all learned to School which were to study Syntax from Word to Sentence. I reverse this Direction and I proceed from Sentence to Words. I can even hear the Linguists far away: Burn him, burn him on the Pyre to appease the Gods!

A difficult Issue that exists in "Grammar and Syntax"-Books is that the Scientists on the Subject have a completely different Approach to the Subject of Language, and in addition, they will introduce Terms in their Definitions before the Terms are already defined. Worst of all, they don't have a mechanistic Approach to Language as the Engineers approach applied Sciences. I will try to remedy this Situation here, but remember I am outside my Environment.

Syntax is a great Subject but not if you are in the neurodivergent Spectrum like me, the Author of this Book. Most of neurodivergent Persons have a Working-Memory that disregulates the Speech and the Interpretation of HumanCommunication. Thus the Text you read is somewhat problematic in many Subjects, sorry.

I keep only a few Definitions and in fact very Introductory here. The Word "few" is still "many", due to the Vastness of the Syntax. I am not expecting you to learn these Items, I only try to show you some Implications that can cause.

19.1 Writing a Concept

We use Writing to store Concepts [1] where we later can retrieve them. Typically a Context will generate a Concept, under the Demand of a Problem, where Ideas gradually populate our Minds and then give their Place to Thoughts which we write on Paper or any other Medium (e.g. Computer).

E.g. If you are working in a ClothesShop ("working in a ClothesShop" is the Context) you might have the Problem of collecting the mixed Clothes that the Customers leave where you get the Idea that each Cloth get a Label at the Back of it, to indicate its StorageArea. Then you write the Idea, and you place your Idea as Thoughts on Paper.

A Writer collects his thoughts as Sentences.

As said previously, a Sentence is a WordsGroup that describes a clear Meaning. To deliver such a Meaning you need

[1] This Section was inspired from the first Pages of [Haynie]

a WordsQuality and proper WordsPlacement according to the Rules of the HumanLanguage of your Country. Syntax, which is the Study of WordPlacement in Sentences according to the Rules of Meaning, comes as a Tool for writing properly your Meaning; however Syntax will not define for you your Meaning! I.e. you can write all the Sorts of Absurdities and still the Absurdities to be nicely served in Sentences.

Syntax focus on Sentences and their constituent Parts the Words. Above Syntax, the Science of Literature and technical Writing (which are not Part of this Book) are your next Step.

19.2 SentenceTypes by emotional Context

When we describe something in a Sentence then it belongs to one of the five SentenceTypes in English according to emotional Context:

- Declarative Sentence
- Interrogative Sentence
- Imperative Sentence
- Optative Sentence
- Exclamative Sentence

These Sentences are now defined:

Def. 19.2.0.1*:* **Declarative Sentence:** is the one that makes an Declaration or Affirmation or Negation.

E.g. The Room smells clean.
E.g. He is important.
E.g. He is not important.

Def. 19.2.0.2*:* **Interrogative Sentence:** is the one that provides a Question.

E.g. Did you open the Door?
E.g. Why you came back?

Def. 19.2.0.3*:* **Imperative Sentence:** is the one that provides a Command or Request.

E.g. Please, Stop!
E.g. Jim clean your Room!

Def. 19.2.0.4*:* **Optative Sentence:** is the one that provides a Wish.

E.g. Lets hope so!
E.g. I wish!

Def. 19.2.0.5*:* **Exclamatory Sentence:** is the one that provides Emotion.

E.g. Ouch!
E.g. Oh, I didn't notice that you are also into BDSM!

Sometimes a Sentence may contain two or more Parts that belong to different SentenceTypes; in this Case, we have mixed Sentences.

Questions and Exercises

1. What is declarative Sentence? Give an Example.
2. What is interrogative Sentence? Give an Example.
3. What is imperative Sentence? Give an Example.
4. What is optative Sentence? Give an Example.
5. What is exclamative Sentence? Give an Example.

19.3 Elements of Sentence

A Sentence is divided into Parts of unique and associative Meaning. These Parts are called "SentenceElements".

Def. 19.3.0.1*:* **SentenceElement:** is the SentencePart that can be either a Word, or grammatical Phrase or grammatical Clause.

A unique Meaning is delivered by Words (more detailed you die!) and associative Meaning, i.e. Meaning that associates with many Things, is delivered by Group of Words called "grammatical Phrases" and "grammatical Clauses". I will define these Terms later.

E.g. "I speak", has two Words, that each deliver their unique Meaning, "I" and "speak". When we look the Sentence "I speak", we can see that it uses two Words that somewhat associate. This Association would be somewhat problematic to deliver Meaning if it was written as "speak I".

A Sentence can contain one or more smaller Sentences that somehow interrelate; these smaller Sentences are called "grammatical Propositions".

Def. 19.3.0.2*:* **Grammatical Proposition (Syntax)(Definition 1) AKA Proposition:** is a meaningful Statement. [2]

I will again define grammatical Proposition, more robustly later within this Chapter.

I spoke previously on the **grammatical Subject**, describing as a Word within a Sentence that describes a Performer (or Recipient) of an Action.

E.g. "John fixed his Car", has "John" as grammatical Subject.

When we are investigate Sentences, we are also interested on the Target of the grammatical Subject, the **Predicate**. The Predicate consists of a Verb and optionally (but according to Context) Words and grammatical Propositions.

Def. 19.3.0.3*:* **Predicate:** is the Part of grammatical Proposition that describes the Action of the grammatical Subject, and consists of a Verb and optionally a grammatical Object or a grammatical Phrase.

E.g. In the Sentence "John fixed his Car", the Subject is "John" and the Predicate is "fixed his Car".

Having defined the Predicate, it is Time to define the grammatical Proposition based on Predicate.

Def. 19.3.0.4*:* **Grammatical Proposition (Syntax) (Definition 2) AKA Proposition:** is the SentencePart composed of a grammatical Subject and a Predicate.

Note that sometimes the Word "grammatical Clause" is used instead of grammatical Proposition, with the Intention to separate individually the Meanings within a Sentence consisting of more than one Proposition. Consequently:

Def. 19.3.0.5*:* **Grammatical Clause AKA Clause:** is the SentenceElement consisting of a grammatical Proposition with the Intention to deliver the Meaning of the grammatical Proposition within the Sentence.

Another Word that we encountered in the Sentences was the one of "grammatical Object" as a Word that describes something affected by an Action introduced by the grammatical Subject.

E.g. "John fixed his Car" has "John" the grammatical Subject and "his Car" as grammatical Object.

Previously I spoke of the Word "Phrase" as a SentencePart. A grammatical Phrase is the Part of a Sentence that excludes the Subject and the Verb.

Def. 19.3.0.6*:* **Grammatical Phrase:** is the PredicatePart consisting of either a Preposition and an Object or the "to" and an Infinitive.

E.g. "The Cloud is above the Man", has grammatical Phrase "above the Man"

[2] Compare this Definition with "Proposition" in Science, as any Statement that can be either true or false; I here define a distinct, temporary Category, the one I call "meaningful".

with Preposition “above” and Object “the Man”.

E.g. “The Cloud is to bombard”, has grammatical Phrase “to bombard” which is the Particle “to” with the Infinitive “bombard” [3]

You should now reread this Section to clear up your Notions.

Questions and Exercises

1. What is SentenceElement?
2. What is grammatical Proposition?
3. What is Predicate?
4. Find the Subject (S) and the Predicate (P) in the Sentences ***TBD*** .
5. What is grammatical Phrase?
6. Find the grammatical Phrases (P) in the the Sentences ***TBD*** .
7. What is grammatical Clause?
8. Find the grammatical Clauses (C) in the the Sentences ***TBD*** .

19.4 Internal Details in Sentences

A Sentence besides its Constituents, the so called “SentenceElements”, these are the Word, the grammatical Phrase and the Clause, has also an internal Division consisting of principal Elements and subordinate Elements.

Principal Elements describe what the Sentence mainly delivers, that is the Context of the Sentence.

Def. 19.4.0.1*:* **Principal Element:** is the fundamental SentencePart and can be either a grammatical Subject or a Predicate.

[3] Yes, Clouds can be “bombarded” with SilverIodine for promoting a Rain, called “artificial”.

E.g. The Sentence “He drinks” has two principal Elements, the grammatical Subject “He” and the Predicate (which here is only a Verb) “drinks”.

However the Sentence might have additional Elements called “subordinate Elements” that assists the Context of the Sentence by adding complementary Information. Obviously these Elements are subordinate (i.e. they have a Position in the Context but a lesser Importance to it) to the principal Elements.

Def. 19.4.0.2*:* **Subordinate Element:** is the SentencePart that depends on principal Elements and modifies them.

E.g. The Sentence “The angry Jim went Home” has the subordinate Element “angry”, which is an Adjective.

E.g. The Sentence “Jim went carefully Home” has the subordinate Element “carefully”, which is an Adverb.

E.g. The Sentence “Jim went to a Place called Home” has the subordinate Element “to a Place called Home”, which is a grammatical Object.

These Sentences reveal that subordinate Elements are only three Types:

- The “Adjective”-Element
- The “Adverbial”-Element
- The “Object”-Element

Consequently all the subordinate Elements mentioned are either Adjectives, Adverbs or Objects or at least larger SentenceElements with the same Function.

Questions and Exercises

1. What is principal Element?
2. What is Subordinate Element?
3. What are the three Types of Subordinate Elements?
4. Find in the Paragraph the principal (P) and subordinate (S) Elements. ***TBD***

19.5 The SentenceElements and their Function in Sentence

Since Syntax provides Meaning in a Sentence, we know that SentenceElements can either be used as grammatical Subject and Predicate. Consequently, they are called "Word"-Element, "Phrase"-Element and "Clause"-Element when refer to the Decomposition of a Sentence to its Elements.

Def. 19.5.0.1*:* **"Word"-Element:** is a single Word and can be used as either a grammatical Subject or a Predicate.

E.g. "He feels" has two "Word"-Elements, one, "He", serves as grammatical Subject, and the other, "feels", serves as Predicate.

Def. 19.5.0.2*:* **"Phrase"-Element:** is a grammatical Phrase and can be used as either a Subject or a Predicate.

E.g. "Above the Clouds is to laugh" has two "Phrase"-Elements, the one, "Above the Clouds" which is a Preposition and an Object, and the other, "to laugh", which is an Infinitive grammatical Phrase.

Def. 19.5.0.3*:* **"Clause"-Element:** is a grammatical Clause that can be used as either a grammatical Subject or a Predicate.

E.g. "Since I am sorry is true", has the "Clause"-Element "Since I am sorry" as grammatical Subject.

E.g. "The Situation is that he failed" has the "Clause"-Element "that he failed" as the Predicate.

Questions and Exercises

1. What is "Word"-Element?
2. Find the "Word"-Elements in the Paragraph. ***TBD***
3. What is "Phrase"-Element?
4. Find the "Phrase"-Elements in the Paragraph. ***TBD***
5. What is "Clause"-Element?
6. Find the "Clause"-Elements in the Paragraph. ***TBD***

Chapter 20

The WordModification

20.1 Similarity and Opposition

The two Words can be similar in Meaning or opposite in Meaning. By carefully using the Context and an available Vocabulary we can use and reuse Words by deploying similar Words. In addition, by correct Use of Words of opposite Meaning, we can refine our Thoughts.

Def. 20.1.0.1*:* **Synonym:** is a SentenceElement with the Property that is identical or approximately meaningful to another SentenceElement.

E.g. Soldier and Warrior are Synonyms with "Warrior" roughly approximating the Noun "Soldier" [1] .

A more approximate Example are the Words "big" and "large", with "big" referring to something exerting a unique Volume, while "large" referring to something sufficiently voluminous.

Def. 20.1.0.2*:* **Antonym:** is a SentenceElement with the Property that is opposite or approximately opposite to another SentenceElement.

E.g. "small" has Antonym the Word "large".

Dictionaries of Synonyms and Antonyms are very common for Use in correct Writing. Concerning Technologies and Sciences, there Glossaries that are provided, contain and denote their respective Synonyms and Antonyms.

[1] These are of Course simple Approximations but you get the Point. I use simple Approximations for Memorization in this Book.

20.2 Prefixes and Suffixes

Words are actually not fixed Character-Combinations. They have an Elasticity and CombinationCapacity that allows them to Form different Words by adding their Body, the Stem, to smaller Words of definite Function, the Particles.

Def. 20.2.0.1*:* **Stem:** is the Part of the Word that can be used for Combination with other Words.

Prefixes and **Suffixes** are "Particles" that modify the intimately the associated Words. According to [Nesfield], "Prefixes alter the meanings of words, while suffixes alter their functions". The Meaning refers to the different Meaning a Word can attain, while the Function refers to a different Form of Word or even a different Part of Speech.

Prefixes are used for attaching Properties to Words such as the Meaning of the Word is altered. E.g. non-, per-, trans-, post- etc are all Prefixes. By Definition:

Def. 20.2.0.2*:* **Prefix:** is a Particle attached at the front of a Word with the Purpose to add an intimate Meaning to a Word.

E.g. The Prefix “post” is used to represent the Word “after”, Posthistory.

Suffices are used for changing the Function of Words.

Def. 20.2.0.3*:* **Suffix:** is a Particle attached at the front of a Word with the Purpose to add an intimate Function to a Word.

E.g. The Verb “take” has the Stem “tak” and can be attached to Suffix “ing” to denote the “continuous Present”-Tense, i.e. “take”, in “simple Present”-Tense and “taking”, in “continuous Present”-Tense.

E.g. “-ful” can be attached to Noun “Doubt” to give the Adverb “doubtful”.

`[Nesfield]` contains Lists of Prefixes and Suffixes. Such Lists are important to the Formation of new Words. An Additional List is provided by `[Stormonth]`.

20.3 Modification

Sometimes to describe Complexity you need add Words to accompany other Words. This Action is called Modification.

E.g. The Sentence “The Man drinks”, can become modified as “The angry Man drinks”.

E.g. The Sentence “He went”, can become modified as “He went suspiciously”.

A Modifier is a Word or even a Phrase that modifies another Word or Phrase. Formally said:

Def. 20.3.0.1*:* **Modifier:** is a SentenceElement that can be Added to another SentenceElement to alter its Meaning.

The most common Modifiers are the Adjectives and the Adverbs, where the Adjectives modify the Nouns and the Adverbs modify the Verbs.

The Modifier targets a specific SentenceElement called the “ElementBasis”. Formally said:

Def. 20.3.0.2*:* **ElementBasis:** is the SentenceElement which is the Target of the Modifier.

Typically you have simple SentenceElements, which are the ones without Modifier and complex SentenceElements which are the ones with Modifier.

Def. 20.3.0.3*:* **Simple SentenceElement:** is the SentenceElement without Modifier.

E.g. The Sentence “The Man drinks”, has the Simple SentenceElements “Man” and “drinks”.

Def. 20.3.0.4*:* **Complex SentenceElement:** is the SentenceElement with Modifier.

E.g. The Sentence “The angry Man drinks carefully”, has the complex SentenceElements “angry Man” and “drinks carefully”.

20.4 WordCombination

A Sentence can use many Words to refer to different Things and can eventually confuse the Reader. About the Writer I don’t speak since he is the most confused of both! Typically a Word will act on another Word which references another Word.

E.g. The Sentence “Tom gave the Car of Jim to Tina” gives a Reference to Tina, that the Car belongs to Jim.

Until now everything is fine, and we can live with it. The Things get an ugly Turn, when we start to reference complex Concepts.

E.g. The Sentence “**The State Register is the Part of the Instruction Register of the Decision Program of the System that affects the Micro Processor.**” has 10 Nouns, and 3 possessive Prepositions “of”. 8 Nouns can form direct WordCombinations of Nouns to reduce the mental Encoding of the Sentence, as “**The StateRegister is the Part of the InstructionRegister of the DecisionProgram of the System that af-**

fects the Microprocessor." However the possessive Preposition "of" cannot be easily removed.

For now.

Depending the Complexity of a Sentence, we can use WordCombinations in Order to explain a difficult Concept without Extension of the SentenceElements. Words can be combined to show different Aspects of Reference. These Words are called CompoundWords.

Def. 20.4.0.1*:* **CompoundWord AKA Compound:** is a Word consisting of two or more Words.

E.g. FileName, WorldView, turnaround, breakup.

There are three Forms of CompoundWords in English language.

- Solid Form: Here the Words are combined without Space between them. E.g. FileName
- Open Form: Here the Words are combined but with Space between them. E.g. File Name
- "Hyphen"-Form: Here the Words are combined with a Hyphen between them. E.g. File-Name

All Forms can be found in a single Text from the any Writer since there are Rules that are used AND abused. The Purpose of this Section is to reveal the most common Use and provide the Semantics that CompoundWords are used. A special Section is provided for the Understanding of the CompoundWords as used by the Author of this Book who is not a native English Person [2] . In general, the Writer has to work on CompoundWords very frequent. The Process to use and develop CompoundWords is called Compounding.

[2] A this Point I would like to say "Sorry", to Shakespeare, his Wife, the whole Academy of Sciences, the Music Group "Blur", the guys at the IEEE, Ray Murphy etc for the Use of English that I use and promote. Sorry Guys, but there were not many Options around for me. We can use of course German or ancient Greek if you like.

Def. 20.4.0.2*:* **Compounding:** is called the CombinationProcess for forming CompoundWords

For Compounding any SpeechPart can be used but there are some Constraints that must be addressed by Grammar, contemporary WordUse as well as common Sense [3] .

20.4.1 The Parts of WordCombination

The CompoundWord reflects the Meaning of the main Word it refers. This Word is called "Head".

Def. 20.4.1.1*:* **CompoundHead AKA Head:** is the main Word used as the reference in the Formation of a CompoundWord.

E.g. The CompoundWord "DataFile" is composed of two Nouns. The Noun "File" is the "Head" of the CompoundWord.

The descriptive Word in the CompoundWord is modifies the Head of CompoundWord and in this way specializes the meaning of the "Head". This word is called "Modifier".

Def. 20.4.1.2*:* **CompoundModifier:** is a Word that modifies the Meaning of the "Head" of the CompoundWord

.

In the CompoundWord "DataFile" the Word "Data" is the CompoundModifier.

20.4.2 Combinations of CompoundWords

The typical Combinations of SpeechParts refer to their grammatical Semantics, that is, in which SpeechPart they belong and eventually their Semantics. There are mostly the following Combinations where the first SpeechPart is the Modifier of the second SpeechPart.

[3] if you have any left, last Time I checked yours it was zero. Wrong, it was minus☺

Making Things worst, these Combinations are not necessary inclusive since the Words can be used as Nouns and non-Nouns. For all Purposes and if you are not sure use a printed Dictionary [4] .

- Noun+Noun=Noun E.g. FileName
- Adjective+Noun=Noun E.g. Whitecase
- Verb+Noun=Noun E.g. Opencase
- Preposition+Noun=Noun E.g. Overlord
- Noun+Preposition=Noun E.g. Hangover
- Gerund-Noun Combinations=Noun E.g. CheckingGate, GateChecking, ReadingWriting
- Adjective+Adjective=Adjective E.g. silvergreen
- Noun+Adjective=Adjective E.g. fireblue
- Preposition+Adjective=Adjective E.g. oversweet
- Adverb+Preposition=Adverb E.g. forthwith
- Noun+Verb=Verb E.g.
- Adjective+Verb=Verb E.g.
- Verb+Verb=Verb E.g.
- Preposition+Verb=Verb E.g. overact
- Verb+Preposition=Verb E.g. take-off
- Adverb+Verb E.g. downsize
- Verb+Adverb=Adverb
- Preposition+Adverb=Adverb
- Adverb+Adverb=Adverb E.g. henceforth

[4] I still use printed Dictionaries but also "non printed"-Dictionaries. When you study all of your Life, you need many Dictionaries.

20.4.3 Portmanteau AKA lexical Blend

A **Portmanteau** is a Contraction of two Words that lead to another Word. By Definition:

Def. 20.4.3.1*:* **Lexicalblend AKA Portmanteaux:** is a WordCombination with Reduction of either Letters, Syllables or Stems of the participant Words

E.g. The Word "Smog" is a Lexicalblend of the Words "Smoke" and "Fog". The Lexicalblend can also be formed by combining an Acronym of the first Word with a Hyphen and the second Word. E.g. E-mail, E-Bike, E-Moron.

20.4.3.1 Directives for writing CompoundWords in this Text

The following Directives are all mine and are based on discriminating the Context of any Text.

- The First letter of a Paragraph or a Sentence or a Title is Written Capitalized. E.g (Paragraph) The Car let Alice outside... E.g. (Sentence) Alice was three days sick,... E.g. (Title) Mathematics
- Nouns are written with the first Letter capitalized. Also capitalized Adjectives used as Nouns. E.g. Richard, Career, Car, E.g. (Adjectives as Nouns) Blue, Sweet.
- Non-nouns are written lowercase unless they start a Paragraph or a Sentence or a Title. E.g. and. E.g. (Start of Sentence) And then Alice...
- CompoundWords that are Nouns are written as Nouns. E.g. Hotchick.
- CompoundWords that are non-Nouns are written as non-Nouns. E.g. overdrive

- Use CompoundWords to simplify the Text and not to make it difficult to read. E.g. “Kennedianpolitics” instead of the correct “Kennedian Politics”. A little of common Sense is always a Virtue.
- Use CompoundWords for frequently used Terms.
- When you right complicated Text, use CompoundWords instead of Nouns with “of”. E.g. use “FileName” instead of “Name of File”
- Generally avoid to write CompoundWords with three Nouns and use instead “of”. E.g. use “FileName of Disk” instead of DiskFileName. However you should be careful: Long Words are unlikely Candidates for CompoundWords and instead you can use Acronyms. E.g. conditional Signal Assignment Statement is better to be written as CSAS as ConditionalsignalAssignmentStatement. On the other Side, DiskFileName is actually short and is a likely Candidate for Combining.
- CompoundWords that are Nouns consisting of more than two Nouns are capitalized on each Noun. E.g. FileName
- CompoundWords consisting of a Modifier and two Nouns are Capitalized on the Modifier and the second Noun. E.g. HotfileName
- CompoundWords with Phrasal Nouns or Sentences or Words pose a special Problem of Interpretation and consequently can be enclosed into double-Quotes. E.g. “read”-Command, “Cleo”-Project, “and”-Operation, “U.N.”-Directive, “Latex”-Environment, “Information containing”-Entity, “Onedimensional”-CoordinateSystem.
- Opposites and concurrent CompoundWords are written with Hyphen in the Middle. E.g. Black-white, Fighter-Bomber.
- The long CompoundWords when are referred can be broken with Hyphen on their Constituents if these are repeated. E.g. ComputingTechnologies and InformationTechnologies can also be written as Computing- and InformationTechnologies.
- Generally speaking, avoid to create CompoundWords with Adjective as the Modifier. However, frequently used Words accompanied by the same Adjective can form a CompoundWord for Reasons of Nomenclature, especially in technical Literature.

20.4.4 Semantics of CompoundWords

CompoundWords reflect the Complexity of a Study and consequently are used descriptively on each Word.

On the most basic Level of Description a Word will describe another Word such as an Adjective and a Noun.

E.g. old File = old(Adjective)+File(Noun).

Using CompoundWords we extend the Level of Description further than the original Description.

E.g. old DiskFile=old(Adjective) File(Noun) of Disk(Noun).

The Semantics (i.e. Meaning) of CompoundWords can be complicated since there are different SpeechParts other than Nouns that can form a CompoundWord.

E.g. overcoat = over(Preposition)+coat(Verb): meaning to coat something at the surface of it.

E.g. Can you overcoat the airplane with this color?

However if we consider the Semantics of the same Word as Preposition and Noun, we get something very different: Overcoat: a Coat for Winter.

The English Language allows you to Use it, but some common Sense is always required.

Directive: If the Word is not in the Dictionary(general or special) you must specify that is your Word and how to use it.

Roughly speaking, the CompoundWord can be Noun and Non-Noun. For technological Development, it will be more common the Creation of CompoundWords that are used as Nouns. However the Non-Nouns CompoundWords reflect mostly the SpeechParts they refer.

20.5 Various Examples on Combinations.

A Dyslexic or a neurodivergent Person has his own Estimation of Language. These are some Ideas here of how I perceive them.

The WordCombinations avoid the Use of "of" to show Possession, and instead uses NounsCombination. I use "of" to explicitly denote Ownership of Something.

E.g. "Jane is the Wife **of** Jim" [5] .

To implicitly denote Ownership of Something I use two Nouns.

E.g. "FileName", AKA Name **of** File.

I include an "s" within to denote Multiplicity.

E.g. FilesName, AKA Name of Files.

E.g. The Sentence "The precious Development of the Infant is Time-Consuming" is referencing more simpler than the Sentence "The Development of the Infant is Consuming in Time".

Another Example is the Creation of smaller Sentences that are attributive in Nature.

E.g. "This is the Car of Sam". This Sentence can be modified into: "This is Sam's Car" with Use of GenitiveCase.

E.g. "This the Name of File". This Sentence can be modified into: "This is the FileName" with Use of CompoundWord.

[5] whether Jim beats his Wife is not my Business, I warned her before

E.g. "Energy point of View": "Energy"-ViewPoint.

E.g. "TotalFieldIntensity": "Intensity of TotalField"..

20.6 VerbTypes in Sentences

A Verb is used in various Places in a Sentence. However not all Places have the same semantic Gravity of the Verb. The VerbForms that we are looking are:

- Infinitive
- Finite Verb
- "Infinitive"-grammatical Phrase
- Gerund
- Participle

I have spoken about Infinitive which is the main Form of the Verb.

Within a Sentence, the Verb provides a general Claim about the Subject. This Claim is called "Assertion". Formally defined:

Def. 20.6.0.1*:* **Assertion:** is a stated Belief that something is valid.

E.g. "John sells Newspapers" has the Verb "sell" somewhat modified to refer to "John" about what "John" does.

The Assertion in Syntax is done by having the Verb in a Form called "finite".

Def. 20.6.0.2*:* **Finite Verb:** is a Verb in a Form that excludes the Infinitive with "to".

E.g. You can say "I clean" but you cannot say "I to clean". However you say "I clean to feel better", where the "to feel" is the Infinitive with "to" (a Particle).

Remark 20.6.0.1. Consequently the Predicate uses the finite Verb to describe the Action of the Subject.

The Infinitive grammatical Phrase is the one that includes "to" followed by an Infinitive. Such a Phrase is used as a Substitute for Subject, Object, Modifier or Complement.

Def. 20.6.0.3*:* **Infinitive grammatical Phrase AKA InfinitivePhrase:** is a Construction with "to" followed by Infinitive, that acts as a Substitute for a Subject, Object, Modifier or Complement in a Sentence.

E.g. As Subject: "To live is wonderful." here the Infinitive grammatical Phrase is "to live".

E.g. As Object: "John is to vote tomorrow." here the Infinitive grammatical Phrase is "to vote".

Def. 20.6.0.4*:* **Gerund:** is a Noun derived from a Verb and expresses the Noun as a Process.

E.g. "The Kissing of the Girl was great.", has as Gerund the Word "Kissing" which derived from the Infinitive "kiss".

Remark 20.6.0.2. Gerunds are always suffixed with "-ing".

Def. 20.6.0.5*:* **Participle:** is an Adjective derived from a Verb and expresses the Adjective as a Result of a Process.

E.g. "The kissed Guy tried to remain calm.", has as Participle the Word "kissed" which derived from the Infinitive "kiss".

Remark 20.6.0.3. Participles are suffixed with "-ing" or with the "Past"-Form.

E.g. "The delaying Process.", and "The delayed Process."

Questions and Exercises

1. State the Names of VerbForms.
2. What is Assertion?
3. What is Finite Verb? Give an Example.
4. Underline the finite Verbs in the Paragraph ***TBD***
5. What is Infinitive grammatical Phrase? Give an Example.
6. Underline the Infinitive grammatical Phrases in the Paragraph ***TBD***
7. What is a Gerund? Give an Example.
8. Underline the Gerunds in the Paragraph ***TBD***
9. What is Participle? Give an Example.
10. Underline the Participles in the Paragraph ***TBD***

20.6.1 "Finite Verb"-Completion

An Issue with the Use of finite Verbs in the Sentence is the addition of supporting Words to the finite Verb. These Words perform, what is called "Completion", i.e. they complete the Meaning of the finite Verb.

E.g, "He asked" has less Meaning than the Sentence "He asked Jane".

Def. 20.6.1.1*:* **"Finite Verb"-Completion:** is the addition of supporting SentenceElements to the finite Verb, for complementing the Context.

The "Finite Verb"-Completion can be one or more Objects or a Complement.

Some finite Verbs require grammatical Objects to support their Meaning while other finite Verbs do not require any grammatical Objects. And some other finite Verbs can be alone as well as with other grammatical Objects.

Def. 20.6.1.2*:* **Transitive Verb:** is a Verb that applies to a grammatical Object.

E.g. The Sentence “He gives a Present”, has the transitive Verb “give”.

Def. 20.6.1.3*:* **Intransitive Verb:** is a Verb that does not applies to a grammatical Object.

E.g. The Sentence “I’ll wait” has the intransitive Verb “wait”.

Some Verbs are both transitive and Intransitive: E.g. “I open”, “I open the Door”.

Chapter 21

Introduction to Syntax: The SentenceFormation

21.1 Clauses and SentenceStructure

Typically a Building is described as Structure, to denote the different Materials and their Arrangements that in their Cooperation provide the Building. This Term was later taken by Linguists and then mapped to the Grammar. Formally said:

Def. 21.1.0.1*:* **Syntactic Structure:** is the Arrangement of the SentenceElements to a Sentence so that the Sentence will provide an understandable Meaning.

Sentences have syntactic Structures that assist with the Meaning that the Sentences convey. Here we are not so much interested about the internal Details of the Sentences but on the systemic Behavior of Propositions within Sentences.

E.g. Let P1, P2 two Propositions. Then the Sentence "if P1, then P2" describes the Meaning of the Sentence as "if Proposition 1 is true, then Proposition 2 is true."

E.g. "If I bath, then I will feel fresh."

The syntactic Structure consists of one or three Forms, the Following:

- "Simple Sentence"-Structure
- "Complex Sentence"-Structure
- "Compound Sentence"-Structure

Typically when speaking about internal SentenceParts, we consider to speak about "Propositions". When we are speaking about "Meaning", we speak about "grammatical Clauses".

Def. 21.1.0.2*:* **"Simple Sentence"-Structure:** is a syntactic Structure with only one grammatical Clause.

E.g. "I went silently Home". Note that we can have as many Modifiers possible, but still the Sentence remains simple.

Def. 21.1.0.3*:* **"Complex Sentence"-Structure:** is a syntactic Structure with two or more grammatical Clauses.

In the "Complex Sentence"-Structure, one grammatical Clause is the principal Clause and one or more grammatical Clauses are the subordinate Clauses.

E.g. "If I stay Home, I will watch TV", has the principal Clause "I stay Home" and the subordinate Clause "I will watch TV".

Def. 21.1.0.4*:* **"Combined Sentence"-Structure:** is a syntactic Structure with two or more grammatical Clauses that each convey independent Meaning but together induce a Context.

E.g. The Sentence "She cooked the Food and the Kids played", has two independent grammatical Clauses, the "She cooked the Food" and "The Kids played".

Questions and Exercises

1. What is syntactic Structure?
2. What are the three Forms of syntactic Structure?
3. What is "simple Sentence"-Structure? Give an Example.
4. Find in the Paragraph the "simple Sentence"-Structures. ***TBD***
5. What is "complex Sentence"-Structure? Give an Example.
6. Find in the Paragraph the "complex Sentence"-Structures. ***TBD***
7. What is "combined Sentence"-Structure? Give an Example.
8. Find in the Paragraph the "combined Sentence"-Structures. ***TBD***

21.2 Constituents of Sentence

Previously we mentioned that the grammatical Proposition has two Parts, the grammatical Subject and the Predicate, where the Predicate consists of a Verb and either a grammatical Phrase or a grammatical Object. E.g. "John fixed his Car", and "John went to cook", where the grammatical Phrase is either a grammatical Object or Infinitive grammatical Phrase respectively.

The Complement is the Part of the grammatical Proposition that includes either a grammatical Phrase or a grammatical Object. According to

subsectionCapitalization of Nouns "The capitalisation of Noun must be reckoned as a great virtue of the German language" [Attributed to Mark Twain from the Book: A progressive German reader, HARAGOPAL BISWAS, University of Calcutta, 1956.]

21.3 Subject and Object in Sentences

The grammatical Subject and the grammatical Object have special Positions in Sentences. You must remember that grammatical Subject and grammatical Object are both SentenceElements (Words, grammatical Phrases, grammatical Clauses) [1] .

In Statements, the Subject come first, then comes the finite Verb and after the Verb the Object. See Figure ***TBD*** . E.g. The Sentence "The Man opened the Door" has first the Subject, "The Man", then the Verb, "opened", and finally the Object, "the Door".

In Questions, first come the finite Verb, then the Subject and after it the Object. See Figure ***TBD*** . E.g. The Sentence "Opened the Man the Door?" has first the Verb "Opened", then the Subject, "the Man" and finally the Object, "the Door".

21.4 Complement and ComplementTypes

Having spoke on Completion, transitive and intransitive Verbs, there is an important Matter, the Complement. The Complement is the actual added Part to the Act of Completion and obviously does not contain the Verb or the Subject, but a grammatical Phrase or an Object. However there is the SubjectComplement that I will define later.

Def. 21.4.0.1*:* **Complement:** is the SentencePart, other than the grammatical Subject and the Verb, and it is used to enhance the Context of the Sentence by performing Completion.

The Complement can be a direct grammatical Object, an indirect grammatical

[1] According to [Haynie], "The grammatical Subject can be either a Symbol or a Character or a Number or a Noun or a Pronoun or a Phrase or a Clause".

Object, an objective Complement and a SubjectComplement.

The direct grammatical Object is grammatical Object, i.e. the one that we use as Recipient of the Action of the Subject.

E.g. The Sentence "He hit the Man." has the direct Object "the Man".

E.g. The Sentence "He hit himself." has the direct Object "himself".

By Definition:

Def. 21.4.0.2*:* **Direct grammatical Object AKA direct Object:** is the primary grammatical Object serving as the Recipient of the Action of the Subject.

The indirect grammatical Object is the grammatical Object that complements the Context of the direct grammatical Object by referencing an Association of the direct Object with someone or something else.

E.g. The Sentence "He told her Facts" has the direct Object "Facts" and indirect Object "her".

By Definition:

Def. 21.4.0.3*:* **Indirect grammatical Object AKA indirect Object:** is the secondary grammatical Object that references the direct Object.

Remark 21.4.0.1. In the SentenceStructure, the indirect grammatical Object precedes the direct grammatical Object. If the indirect grammatical Object is after the direct grammatical Object, then it is preceded by "to" or "for".

E.g. The Sentence "He tried Heroin for his Love." has the indirect grammatical Object "his Love". Its amazing that a single Picture of Sid Vicious that I saw this Morning, gave me this Example.

The objective Complement is a Noun or Adjective that supports the direct grammatical Object by SelfReference; this is the Opposite in Action of indirect grammatical Object (where a different grammatical Object references the direct Object).

E.g. The Sentence "He made the House colorful", where the "colorful" is the objective Complement.

Def. 21.4.0.4*:* **Objective Complement:** is a is a Noun or Adjective that supports the direct grammatical Object by SelfReference.

The SubjectComplement is a SentenceElement that directly references the grammatical Subject.

E.g. The Sentence "The Salesman was a User" has the Noun "User" as SubjectComplement .

E.g. The Sentence "He is crazy" has the Adjective "crazy" as SubjectComplement.

Def. 21.4.0.5*:* **SubjectComplement:** is a SentenceElement that selfreferences the grammatical Subject.

Questions and Exercises

1. What Complement?
2. What is direct grammatical Object?
3. What is indirect grammatical Object?
4. Find in the Sentences the direct (d) and indirect (i) Objects. ***TBD***
5. What is objective Complement?
6. What is SubjectComplement?
7. Find in the Sentences the direct (d) and indirect (i) Objects. ***TBD***

21.5 Negation in Sentences

Sometimes we need to form the Opposite of a Sentence.

E.g The Sentence "He wears red" has the Opposite "He does not wear red". If we consider that someone said "He wears blue", this is not the Opposite! This is his

Interpretation of the Opposite. By affirming that something is not what is supposed to be, we perform Negation.

Def. 21.5.0.1*:* **Negation:** is the Act of Forming the opposite Meaning on a Proposition.

Sentences can be negated by using the Forms of "not" correspondingly to the VerbUse with Tenses.

E.g. The Sentence "He works" is negated with the Verb "do" and the Adverb "not", as "He does not work".

E.g. The Sentence "He is working" is negated only with the Adverb "not", as "He is not working".

Typically the Sentences that have a "non Negative"-Proposition, in this Book are regarded as "positive", while Sentences with a Negation are regarded as Negative.

Negation can also occur with Adjectives, e.g. the Sentence "Neither of Both did this.", or with other SentenceElements. ***TBD***

21.6 Conditional Sentences

Conditional Sentences are the Ones that contain typically two grammatical Clauses, where one grammatical Clause serves as a Stipulation i.e. Condition, for the other to happen.

E.g. The Sentence "When you go for Exams, you ask the Teacher to use Condom (there are many Diseases around)", has two grammatical Clauses, the first is used as the Target of Stipulation,"you go for Exams", while the other is used as if the Stipulation is taken "you ask the Teacher to use Condom".

Formally:

Def. 21.6.0.1*:* **Conditional Sentence:** is a Sentence formed by two grammatical Clauses, where the one serves as a Condition for the Implementation of the other.

The grammatical Clauses in conditional Sentences have the names **"if"-Clause** and **main Clause**.

Def. 21.6.0.2*:* **"if"-Clause AKA conditional Clause:** is a grammatical Clause that represents a demanded Stipulation.

Def. 21.6.0.3*:* **Main Clause AKA Target:** is a grammatical Clause that represents an Action to be carried or an Event to happen.

E.g, in Sentence "If I open the Door, then I will enter the Building." the "if"-Clause is "I open the Door" and the main Clause is "I will enter the Building".

Since the conditional Sentence demonstrates Causality, it is used in Science and in particular Logic, to form causal Statements. In this Case the Terms "Antecedent" and "Consequent" represent "if"-Clause and main Clause respectively.

Any Clause can be used to form a Part of the conditional Sentence, but not all the Clauses have the Capacity to make reasonable Statements.

E.g. The Sentence "If Oh, I saw Jim then he became earlier Doctor" does not obviously fit.

Some Operation on a clear Mind (leave the Bottle of Vodka now!) can help to make good conditional Sentences.

Conditional Clauses can be formed with a Variety of Ways and References to the TimeDimension and Modality.

E.g. Speculation: "If I had Money, I would be happy".

Questions and Exercises

1. What is conditional Sentence?
2. What is conditional Clause?
3. What is main Clause?
4. Mark the conditional (c) and main (m) Clauses in the Sentences. ***TBD***

Chapter 22

Inductive and deductive Argument

Narrative

We use Data to discover new Things by applying the sampled Data to our Interpretation. The Problem that arises often is the Method of Interpretation that we use.

In this Chapter, I will speak about two Methods of Interpretation, the Deduction and Induction. Both of them can give us Arguments but the Way that derive their Conclusions can lead to false Interpretation.

22.1 Claim and Speculation

I have mentioned previously that an Assertion is a stated Belief that something is valid.

E.g. The Sentence "Jim is innocent!" is an Assertion about "Jim", that is provided without any Evidence (or even Context).

An Assertion provides the Belief without any Evidence and as such, does not apply to the Context of scientific Discovery. We can define another Word instead of "Assertion" to make clear our Opinion. Correlated to the Term "Assertion" is the Word "Claim". This is slightly different since it refers to an Opinion of the Person (the "Claimant") about the Validity of his Belief. Formally said:

Def. 22.1.0.1*:* **Claim:** is a ValidityAssertion of an Opinion.

E.g. Scientist J.P. put forward the Claim that "Man made"-ExhaustGases do not contribute at all to the "green House"-Effect.

When we study something we process the Data and prudently we derive our Opinions by stating Claims about our Data. These Claims we need eventually to prove.

"Speculation" is the Type of Term that you avoid even to mention. Especially in Activities that promise a lot of Money, this Term can raise up Kings as well as Clowns. Speculation is the mental Activity where Premises can be made by pure Assumption without any Proof; as such, Speculation requires at least some Plausibility, leading to the Terms invalid and valid Speculation. Belief is not Part of Speculation but strictly speaking, is frequently encountered.

E.g. an invalid Speculation about a Company trading in the StockExchange is "This Company will fail since does not have Money". Compare with the valid Speculation "This Company will fail since the last 10 Decisions it took were all catastrophic". The first Sentence informs that the Company does not have Money, which Outside the Company is not plausible; however to assert that 10 known Decisions were catastrophic, is plausible though is up to a Debate.

By Definition:

Def. 22.1.0.2*:* **Speculation:** is the mental Activity where Premises are obtained by valid Anticipation and Belief both based on Luck of Evidence.

22.2 Induction

The Induction is a ThinkingProcess where a Person arrives to his generalized Conclusion using a small set of Premises and an incomplete Set of Evidence.

E.g. If you are working hard in the same industrial Facility for 40 Years, you may assume that most if not all the People are also hard Workers since you are based your Thinking to the People that surround you applying the same Effort: working hard.

Formally said:

Def. 22.2.0.1*:* **Induction:** is the ThinkingProcess of Reasoning where a minimal Set of valid Premises leads to a general Conclusion based on an incomplete Set of Evidence.

Needless to say, such a ThinkingProcess is not reliable since a Conclusion demands many verified Facts. Obtaining a Conclusion without much Facts, is not Science, but a Belief.

Induction has a more serious Effect, that is, it can generate a Chain of nonexistent Premises and Arguments that support the Conclusion. In the Diagram shown, 22.1, the Person arrives to his Conclusion using a very small Set of Premises and some Evidence are missing.

Because Humans are logical as well as emotional Creatures, Induction is used very frequently especially in Misinformation as a PersuasionMean to arrive at the demanded Conclusions by using the Expectations and Fears of the People about the Conclusion. Saying that, Induction can be used positively as a Mechanism for a PatternDetection until more Evidence can lead to a valid Conclusion.

E.g. Seeing that in a City the most of Blacks are related to a Crime can lead to

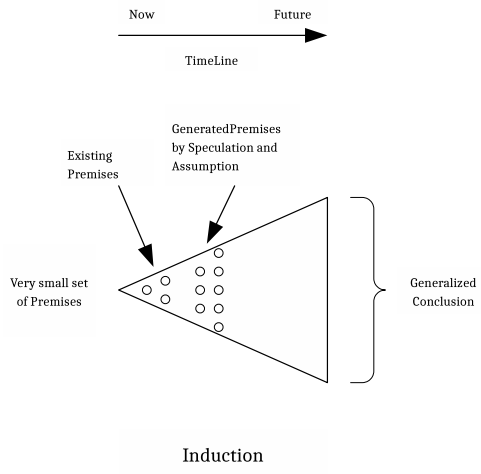


Figure 22.1: Induction, shown here as a Triangle, where a few Premises generate Speculation or Assumption about other Premises that eventually end up in a generalized Conclusion. Since Induction is a ThinkingProcess, a TimeLine, starting from the Inception of Induction and ends to the generalized Conclusion.

the false Conclusion that all the Blacks are bad. However the Investigation of this Pattern can lead one Scientist to find out that the Crime in their Areas is not punished, since some Politicians want to replace the public Policing (Police based on the Authority of the Country) with a private Policing (Police based on the Authority of a Corporation that provides Services to the Public) for the Purpose of gaining themselves a private Army, and as such, they allow Crime to happen [1] .

Associated with Induction, is the Argument based on Induction, the inductive Argument:

Def. 22.2.0.2*:* **Inductive Argument:** is the logical Argument based on the ThinkingProcess of Induction.

22.3 Deduction

The Deduction is a ThinkingProcess where a Person arrives to his specialized Conclusion using a small Set of Premises and a complete Set of Evidence.

E.g. If you are working with a Set of Customers that represent a good Variety of the political Opinions and you have the Means to know their Opinions, you can, by Approximation, conclude what is the current political Orientation of the Population.

Formally said:

Def. 22.3.0.1*:* **Deduction:** is the ThinkingProcess of Reasoning where a maximal Set of valid Premises leads to a specialized Conclusion based on a complete Set of Evidence.

[1] Such a Claim from my Side might seem absurd. Funnily enough, autonomous SecurityServices are also a Target by Corporations since they can provide the Power of Violence that legally speaking, it is the Ownership of the State (i.e. the Public) and not of Individuals or Oligarchies (i.e. very rich Persons or Corporations). Since Politicians are intimately binded with Corporations, I will not mention Names here, but I left some Clues. Those who can think, can trace.

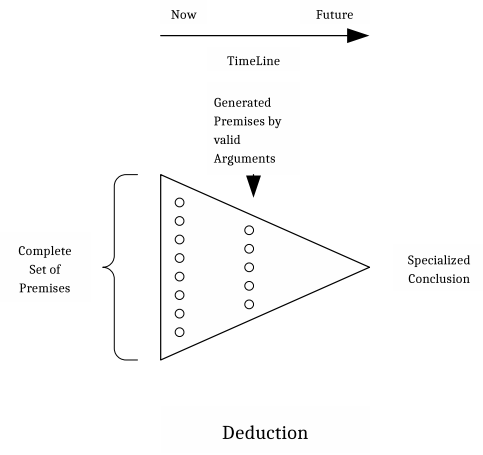


Figure 22.2: Deduction, shown here as a Triangle, where a maximal Set of Premises generates new and valid Premises that eventually end up in a specialized Conclusion. Since Deduction is a ThinkingProcess, a TimeLine, starting from the Inception of Deduction and ends to the specialized Conclusion.

Deduction demands Facts to arrive on a Conclusion and as such it has a high Reliability. However, finding Facts is difficult, mostly because very often you need to define precisely what you are looking. This is the most difficult Part in Deduction.

In the Diagram shown, 22.2, Deduction starts with many Premises and arrives to a Conclusion.

Associated with Deduction, is the Argument based on Deduction, the deductive Argument:

Def. 22.3.0.2*:* **Deductive Argument:** is the logical Argument based on the ThinkingProcess of Deduction.

Questions and Exercises

1. What is Assertion? (Repetition of Term)
2. What is Claim?

3. What is Speculation? Do you have any Brain to give a Speculation, sorry, a Definition for this Term or you're still drunk?

4. Identify the Statements as inductive (I) and deductive (D). ***TBD***

Chapter 23

Operations and their Participants

Narrative

In this Part I will examine what can be done to Propositions and how Propositions can be used in larger Statements. The whole Idea here is that Propositions can be made Parts of larger logical Structures that can be used to assist the Formation of Arguments.

This Introduction here is important to assist you at Analysis as well at Science in general, since the Terms are used in almost the same Fashion across different scientific Areas.

23.1 Operators, Operations and Operands

Whenever you analyze the Content and Context of a Paragraph, you need not only to understand the Participants, their Roles and their Actions, but also process their Actions in a wider Scenario, which might as well push you to rephrase Sentences.

Though the Actions in Inference concern Statements (Propositions) their Extension is much wider and includes besides Philosophy and Thinking, also Mathematics and Engineering, to name a few.

The Term "Operation" refers to the Action of Processing:

Def. 23.1.0.1*:* **Operation:** is called the Act of carrying a Process.

E.g. A surgical Operation.
E.g. A MilitaryOperation.
E.g. A FlirtingOperation.
E.g. A RepairOperation.
The Operation acts on Objects called Operands.

Def. 23.1.0.2*:* **Operand:** is called the Object acted upon by an Operation.

E.g. The Patient is the Operand in a surgical Operation.
E.g. The Enemy is the Operand in a military Operation.
E.g. The Girl is the Operand in a flirting Operation of which you failed. Accept it.
E.g. The Car is the Operand in a RepairOperation.
While the Operation acts on Objects, another Item binds the Objects to perform the Operation and is considered to actually carry out the Process. This is the Operator and is itself an Object.

Def. 23.1.0.3*:* **Operator:** is called the Object that performs a Process.

E.g. The Surgeon is the Operator in surgical Operation.
E.g. The Soldier is the Operator in a MilitaryOperation.
E.g. The Guy is the Operator in flirting Operation.
E.g. The Mechanic is the Operator in RepairOperation.
An Operation has an Outcome which is called Result.

Def. 23.1.0.4*:* **Result:** is the Outcome of an Operation.

E.g. An Arrest (Operation) is made when a Policeman (Operator) catches (the Verb is actually here "arrest") a Felon (Operand). The Result of the Operation is also called "Arrest".

E.g. An arithmetic Addition (Operation) is made when the "Plus"-Sign (Operand) is between the two Numbers (Operands) 2 and 3; this is mathematically denoted as $2 + 3$ and results to a Value 5. The whole Operation is denoted as $2 + 3 = 5$ where the "equals"-Sign precedes the Result.

Questions

1. What is "Operation"?
2. What is "Operand"?
3. What is "Operator"?
4. What is "Result"?
5. A Salesman appears at the Door of a House selling Pans to a Woman. Identify the Operator, Operand, Operation and Result, if a Sale is made [1] .

23.2 Unary and binary Operators

Some Operators affect only one Operand, while other Operators affect two Operands. These are called unary and binary Operators.

Def. 23.2.0.1*:* **Unary Operator:** is an Operator affecting only one Operand.

Def. 23.2.0.2*:* **Binary Operator:** is an Operator affecting two Operands.

[1] Answer. Operation: Selling, Operand: Woman, Operator: Salesman, Result: Sale.

Having more than two Operands, e.g. x, y, z, affected by an Operation we can use a binary Operator, OP, between two Operands as $xOPyOPz$. Consequently a binary Operator performs an Operation couplewise.

23.3 Variables and Constants

An Operation involves **known and unknown Statements**. Some unknown Statements might be e.g. Premises that we know that they exists but we don't have their Definition. A **Constant** is a known Statement, that is, a Statement which we accept as Fact and typically abbreviated with an UppercaseCharacter with optionally a Number. You must remember at all Times, that the Constant carries a known Value.

Def. 23.3.0.1*:* **ConstantStatement AKA Constant:** is a known Statement.

E.g. T5:="John Doe has a "current Account"-Deficit."

Sometimes a Constant can simple denote a TruthValue.

E.g. T13=F

A **Variable** is a Proposition with an unknown Value and Typically abbreviated with a LowercaseCharacter and optionally a Number.

Def. 23.3.0.2*:* **VariableStatement AKA Variable:** is a Proposition with an unknown Value.

E.g. The Variable "x" in Mathematics denotes an Item that we don't know its Value, however we know for sure that it somehow participates to an Equation [2] , such as $x + 3 = 2$.

Whenever a Variable is evaluated, its Content can either get a TruthValue or the Value of a complete Statement denoting a TruthValue.

[2] An Equation is an Equality of two Items.

E.g. $x = True$. This is "x"- only with a TruthValue.

E.g. $x = y$, where y:="Dogs are reliable HuntingAssistants". x takes the Value of y which is the Statement "Dogs are reliable HuntingAssistants".

Questions

1. What is "Constant"?
2. What is "Variable"?
3. What are the Values that a Variable can take? [3]

23.4 Input- and OutputPort

An Operation is regarded as a Process where an InputPort (attached to the Process) receives Operands, performs an Operation on Operands and provides an OutputPort for exerting the Result. The Terms Input and OutputPort are defined further.

Def. 23.4.0.1*:* **InputPort AKA Input:** is an Entry to a Process where Operands enter to the Process.

Def. 23.4.0.2*:* **OutputPort AKA Output:** is an Exit to a Process where the Result exits the Process.

In the following Diagram the Operator, Operation, Operand, Result, InputPort and OutputPort is shown, see 23.1. Next are sampled Operations on various Subjects, see 23.2.

Questions

1. What is "InputPort"?

[3] TruthValues or complete Statements.

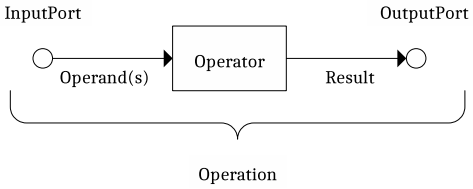


Figure 23.1: The Operation, Operand, Operator, Result, InputPort and OutputPort.

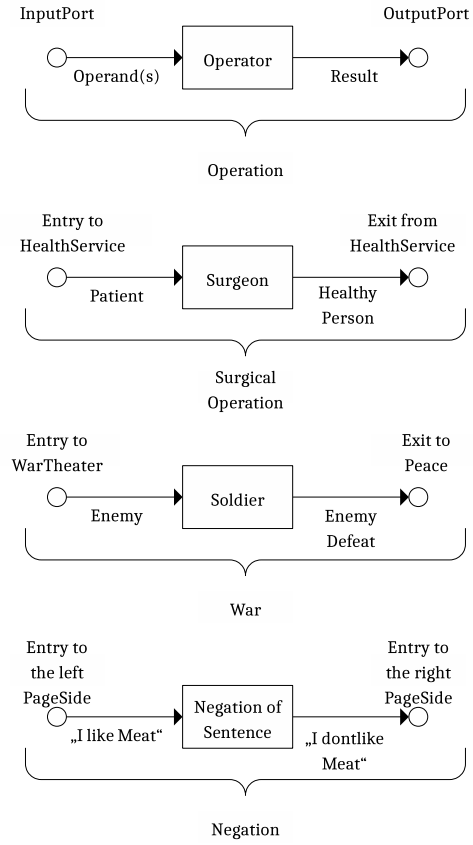


Figure 23.2: The Operation, Operand, Operator, Result, InputPort and OutputPort concerning various Operations, namely "surgical Operation", "War", "Negation". At the Top, is the OperationNomenclature for the Subjects.

2. What is “OutputPort”?

3. Identify the Input- and OutputPort in the following Examples ***TBD***

23.5 Evaluation, Scope and Aggregation of Statements

Group of Statements can be **evaluated** as Part of an Operation, where each Statement is evaluated on its TruthValue. **Evaluation** is the finding of the Result (i.e. Value) of an Operation.

Def. 23.5.0.1*:* **Evaluation:** is the FindingProcess of the Value exerted by an Operation.

The Evaluation is performed **from left to right**, unless your WritingSystem does not allows it (my Condolences, you were a good Guy).

E.g. *xOpyOpz* is evaluated as first the Operands x and y and then their Result evaluated with z. This is done for binary Operators.

For **unary Operators** the Evaluation is still from left to right, but here the Operation evaluates only the first Operand, E.g. *Opx* means that evaluates x and gives a Result.

While an Operator accesses one or two Operands, an Operation may involve more than two Operands. The **Scope of an Operation** concerns the Amount of Space covered by the Action of the Operator where the Space encloses the affected Operands.

Def. 23.5.0.2*:* **OperationScope AKA Scope:** is the SpaceAmount covered by the OperatorAction to affect Operands.

E.g. I took a Shower and the Scope of the ShowerWater was within the BathTub.

The Scope can be unlimited or limited. The Limiting of Scope serves as a **Separator of the Operations** involved as well as the Introduction of **Hierarchy of Operations**. If the **Scope is limited** then the Operations involved can be prioritized by use of **AggregationSymbols** to assist the Hierarchy of Operations. **Aggregation** is the Grouping of Operands and Operators so that their Operation has a certain Priority and Structure with respect to other Operations.

Def. 23.5.0.3*:* **Aggregation:** is the Composition of Participants to a Group.

The Participants are Operators, Operands, Operations, TruthValues, AssignmentSymbols.

Priority refers to the Importance of an Operation within a Set of Operations. By Definition:

Def. 23.5.0.4*:* **Priority:** is called the Order of Execution of a Participant under Operation.
[4]

The Process of assigning Priority to Participants is called **Prioritization**. It is defined as:

Def. 23.5.0.5*:* **Prioritization:** is called the Process of assigning Priorities to a Group of Items.

The Prioritization is based on Criteria given by the Thinker, who also obeys the Rules of Inference concerning his mental Analysis of his Context. Because the Prioritization is very Important in taking Action, various Methodologies (e.g. “Eisenhower”-Method) have been developed to set Priorities (e.g. in “Eisenhower”-Method the Priorities are based on their Urgency and Importance).

Returning to Aggregation, the “AggregationSymbols” are CharactersCouples that enclose one or more Operations. These are:

- The “Parenthesis”-Couple, ( )

[4] **Kill him! Now!** Is impressing that “Execution of a Participant” can mean two different, often beautiful, Things in two very different Contexts 💀.

- The “AngleBrackets”-Couple, [ ]
- The “CurlyBraces”-Couple, **{ }**

AggregationSymbols are used for “Nesting” the Aggregations. However there is a Priority to the Use of AggregationSymbols based on Parenthesis (highest Priority) to CurlyBraces (lowest Priority). Once the CurlyBraces are used, then Aggregation restarts its Cycle with use of Parenthesis i.e. for the Operation “Op” and Participants q p z x y w t:

E.g. A simple Aggregation:

$$[z\ Op\ (x\ Op\ y)]$$

First the “x” and “y” are evaluated (“Parenthesis”-Couple) and then their Result is evaluated with “z” (“AngleBrackets”-Couple) .

E.g. A more complicated Aggregation:

$$\{[q\ Op\ (\{[z\ Op\ (x\ Op\ y)]\ Op\ w\})]\ Op\ t\}$$

The Priorities here are:

1. Operands “x” and “y” are first evaluated since a “Parenthesis”-Couple implies it. Let this Result1.
2. Their Result, Result1, is evaluated with “z” since an “AngleBrackets”-Couple implies it. It gives Result2.
3. Then the Result2 is evaluated with “w” since a “CurlyBraces”-Couple implies it. This gives Result3.
4. Then the Result3 is evaluated by “q” since an “AngleBrackets”-Couple implies it. This gives Result4.
5. Finally the Result4 is evaluated with “t” since a “CurlyBraces”-Couple implies it. This gives the final Result5.

The last AggregationSymbols (“Curly Braces”) are not necessary, but here demonstrate the Order of Priority.

Questions and Exercises

1. What is Evaluation?
2. What is Scope?
3. What is Aggregation?
4. What is Priority?
5. What is Prioritization?
6. Name the three AggregationCouples and their Priority.
7. Allocate to the following Operation the Priorities by underline their PriorityNumber (1, 2, 3, etc) under them.

$$\{[(\{[(x\ OpA\ y\ OpB\ k)\ OpC\ r\ OpD\ m]\ OpE\ w\})\ q]\ OpF\ f\}$$

5

[5] Answer: OpA=1 (x and y), OpB=2 (Result of OpA with k), OpC=3 (Result of OpB with r), OpD=4 (Result of OpC with m), OpE=5 (Result of OpD with w), OpF=6 (Result of OpE with f).

Chapter 24

InferenceOperations

Narrative

The **InferenceOperations** are very simple Operations that carry a logical Result that contains a TruthValue. E.g. if the Premises, P, are true:

- P1="A Bird has only two Legs"
- P2="The Animal observed does not have two Legs"

then the Conclusion C="The Animal is not a Bird" is probably true and obviously both Premises must be taken together. The Word "together" is here an InferenceOperation.

Though the Consequences of InferenceOperations are very Strong and frequently subtle, their Exhibition allows the Scientist to understand his Context and eventually find the Result of his Endeavor.

A small Notice though: The Arguments and Propositions are Part of philosophical and mathematical Logic. As such, here I give some Elements about these Parts and not the whole Story: the Focus is the Reader to gain some Clarity before engaging further with these Disciplines.

24.1 TruthTable in Inference

A Description of the TruthValues of Premises and the Result of their Operation can be shown in the Form of a graphical Artifact called "Table", in particular

S_1	S_2	$S_3 = S_1 OP S_2$
F	F	F
F	T	T
T	F	F
T	T	F

Table 24.1: An Example of TruthTable where Statements S1 and S2 are operated by OP and give Statement S3.

"**TruthTable**". The TruthTable: gives all Combinations (mathematically speaking these Combinations are called "Permutations") leading to Truth and Falsity and serves the exploratory Analysis of the Object of Matter.

Def. 24.1.0.1*:* **TruthTable:** is a graphical Artifact (a "Table") containing all possible Permutations of Statements according to their logical Value.

The TruthTable allocates Space for the Statements (Each Statement has a Column, while each Statement is represented as a Symbol) as well as for their Result of Operation employing TruthValues.

E.g. the Operation "OP" between Statements S1 and S2 results in the third Statement S3 which is true when S1 is false and S2 is true. See 24.1.

The TruthTable does not only have the Purpose to describe all entered Statements but it also has the Purpose to expose Scenarios that the Statements will normally never reach but we need to know what are the Consequences for such Situations

if non-factual Values enter our Inference.

E.g. What are the Consequences in an Investigation if an Evidence on a Subject is false? In this Case, the Statements representing Evidence are evaluated for false Values and the Result should show or not the investigated Claim.

Questions and Exercises

1. What is TruthTable?
2. Why do we need to enter non-factual Values in our Inference?

24.2 Operation of Negation

The **NegationOperation** acts on a Statement such as it negates it. To negate a Statement is to derive a Statement that provides "Absence of its Essence" or "Denial of its Action".

"Absence of its Essence" means that Something is missing.

E.g. The Sentence "Chris is here" has the Negation "Chris is not here".

"Denial of its Action" means that Something is not done.

E.g. The Sentence "Chris works hard" has the Negation "Chris does not work hard".

By Definition:

Def. 24.2.0.1*:* **Negation:** is an Operation on a Statement that either provides Absence of its Essence or Denial of its Action.

Negation is denoted by the Drooping, ¬, Symbol before a Statement.

$$Negation := \neg Statement \tag{24.1}$$

Negation does not mean the opposite Value (if any), but the negating Context.

E.g. A Statement containing Denial is shown: let the Statement S:="You are good". Then the Negation of S is $\neg S$ ="You are not good". This does not mean necessarily bad, but it simple not good. I.e. In a Conflict you can also be neutral [1].

S	$\neg S$
F	T
T	F

Table 24.2: "Negation"-TruthTable

Remark 24.2.0.1. While a Statement carries a TruthValue, the Interpretation of the opposite TruthValue is not necessary the opposite Item of a referred Item but its Absence or Denial.

E.g. S:= The Apple is red. The negated Statement is ¬ S:= The Apple is not red (i.e. it can be green but also a be a yellow Apple).

Negation can affect one or more grouped Statements. E.g. $\neg(S_1, S_2, S_3) = \neg S_1, \neg S_2, \neg S_3$. This Negation will be apparent by Use of various Operators.

The Negation of Statement "S" is shown in Table 24.2.

Questions and Exercises

1. What is Negation?
2. Write the TruthTable of Negation.
3. Negate the Statement: S:="Today exists a FootballMatch"
4. Negate the Statement: S:="Jim is not Gay" [2]
5. Negate the Statement: S:="I will go Shopping"
6. Negate the Statement: S:="Outside is Darkness"

[1] I.e. Watching the Idiots dying while you prepare for conquering them. *Great Moments in History.*

[2] This is called "double Negation" and provided the nonnegated Statement.

S_1	S_2	$S_1 \wedge S_2$
F	F	F
T	F	F
F	T	F
T	T	T

Table 24.3: Conjunction TruthTable

7. Negate the Statement: S:="I don't do it"

24.3 Operation of Conjunction

The ConjunctionOperation, a binary Operation, refers to the Outcome of two or more Statements be true only when all of them are true. It is defined as:

Def. 24.3.0.1*:* **Conjunction:** is an Operation between two or more Statements that results in a true Value if and only if all participating Statements are true.

Conjunction is denoted by the Wedge, $\wedge$, between two or more Statements.

$$Conjuction := S_1 \wedge S_2 \tag{24.2}$$

E.g. If you inspect your Computer inner and outer, and you write the Statements S1:="Computer is working", S2:="ComputerMotherboard is working", then the the Statement $S_3 = S_1 \wedge S_2$ is true if both Statements S1 and S2 are true.

As we see, Conjunction refers incidentally to the grammatical Element "and" which is also a the Part of Speech called (grammatical) Conjunction.

The TruthTable 24.3 lists the Combinations for two Statements.

and Questions Exercises

[3]

1. What is a Conjunction?
2. Write the TruthTable for Conjunction.
3. Find the TruthValue of the Statement $S = S_1 \wedge S_2$ when
   - S1=T, S2=F
   - S1=F, S2=F
   - S1=T, S2=T
   - Find the TruthValue of Conjunction of Statements: S1:="Britain is in Europe", S2:="London is in Antarctic".
   - Find the TruthValue of Conjunction of Statements: S1:="Saab is a Car", S2:="Saab is an Aircraft".

24.4 Operation of Disjunction

Disjunction, a binary Operation, refers to the Outcome of two or more Statements to be true when one or more participating Statements are true.

Def. 24.4.0.1*:* **Disjunction:** is an Operation between two or more Statements that result in a true Value if and only if at least one of the participating Statements is true.

Disjunction is denoted by the inverted Wedge, AKA vee, $\vee$, between the participating Statements:

$$Disjuction := S_1 \vee S_2 \tag{24.3}$$

E.g. If the Statements S1:="Animal with four Legs", S2="Animal with warm Heart" then the Disjuction $S_3 = S_1 \vee S_2$ is true if any one, even both Statements are true.

As we see, Disjunction refers to the grammatical Element "or" which is linguistically speaking a Conjunction [4] .

Next there is the TruthTable for Disjunction in 24.4.

[3] Damn you Dyslexia!

[4] On Context: Here we have a logical Item

S_1	S_2	$S_1 \vee S_2$
F	F	F
T	F	T
F	T	T
T	T	T

Table 24.4: Disjunction TruthTable

Questions and Exercises

1. What is a Disjunction?
2. Write the TruthTable of Disjunction.
3. Find the Value of Statement $S = S_1 \vee S_2$ when:
   - S1=T, S2=F
   - S1=F, S2=F
   - S1=T, S2=T
   - Find the TruthValue of Disjunction of Statements: S1:="A Car is a Vehicle", S2:="London is in Antarctic".

24.5 Operation of Implication

An Implication is called colloquially any SideEffect of an Action. While this is very common in Use, in logical Inference the Implication is a binary Operation demonstrating Causality by binding a valid Premise with a valid Conclusion.

E.g. Let the Premise P="I have a DrivingLicense" and the Conclusion C="I can drive a Car". Then the Implication shows Causality of these Propositions as "If I have a DrivingLicense then I can drive a Car", denoted as $P \Rightarrow C$

Be Definition:

called Disjunction that as linguistic Item is a Conjunction: encountering the same Term in a different Context does not necessary mean that the Term has the same Meaning. *Confusions are Tigers.*

Def. 24.5.0.1*:* **Logical Implication or "If...then"-operation or Conditional Statement AKA Conditional Operation, De. Subjunktion:** is an Operation that demonstrates Causality by binding a Premise (AKA Condition AKA Prerequisite) with a Conclusion.

Remark 24.5.0.1. The Conclusion can also be called "TargetStatement".

Essentially the Logical Implication can be considered the smallest Sibling of Inference, and actually *for the Case where there is one Premise and one Conclusion then Implication is Inference.* However Life is never that simple.

Logical Implication is denoted by the "implies"-Symbol AKA right Arrow, $\Rightarrow$ between the participating Statements: is given as:

$$LogicalImplication := (P \Rightarrow C) \quad (24.4)$$

Where P is the Premise, and C the TargetStatement that will be carried out if the Premise is Valid.

Grammatically speaking, Implication corresponds to the grammatical Conjunction "if" , together with the grammatical Adverb "then", with the former binded to the Prerequisite and the latter to the TargetStatement.

E.g. Prerequisite:="I have a DrivingLicense", TargetStatement:="I can drive a Car" then $Prerequisite \Rightarrow TargetStatement$ corresponds to the Sentence: "If I have DrivingLicense, then I can Drive a Car".

Syntactically speaking, Implication refers to what is known as the "conditional Expression", that is, an Expression that is carried out if a Condition is valid.

Both Prerequisite and TargetStatement have a more formal Name. These Names are defined as:

Def. 24.5.0.2*:* **Antecedent:** is called the Statement that represents the Prerequisite of the Implication.

P	C	$P \Rightarrow C$
F	F	T
T	F	F
F	T	T
T	T	T

Table 24.5: Implication truth table

Def. 24.5.0.3*:* **Consequent:** is called the Statement that represent the TargetStatement.

Having the Idea what Implication is, I must to give a proper Application:

The Implication is a logical Operation that tests the Validity of a Premise and carries out a Task only if the Premise is valid. This simple Operation has enormous Effect in critical Thinking, since it defines when something is allowed to be done or not.

The TruthTable for Implication is shown next 24.5, with an Explanation following.

If both Premise and Conclusion are valid (i.e. both are true), then the Implication is valid, that is, there is a Causality that is represented on the whole Expression $P \Rightarrow C$. However the Implication is also valid if both Premise and Conclusion are invalid (!): it simple means that an invalid Premise will not trigger an invalid Conclusion [5] , consequently the Implication still holds and is valid. Similarly if the Premise is invalid and the Conclusion is valid, the Implication still holds, since the Conclusion is not triggered by the Premise, i.e. the Idea of Causality is still maintained. The Situation where the Premise is valid while the Conclusion is invalid is **very tricky** since it states that the Causality is not maintained if a valid Premise will trigger an invalid Conclusion.

Since this Concept is critical, I will repeat it:

- Causality is maintained if both Premise and Conclusion are valid. This Causality is executed.
- Causality is maintained if both Premise and Conclusion are invalid. This Causality is not executed but demonstrates it's Blocking of the invalid Premise.
- Causality is maintained if Premise is invalid and Conclusion is valid. This Causality is not executed but demonstrates it's Blocking of the invalid Premise.
- Causality is maintained if Premise is valid and Conclusion is invalid. This Causality is not executed if the Conclusion is invalid, i.e. something not intended.

While Implication demonstrates Causality that we can use, the SideEffects of Causality are also present! It is the Idea of these SideEffects that gave the Name "Implication", i.e. unwanted Consequences!

Questions and Exercises

1. What is a Causality? (Repetition of the Term)
2. Write the TruthTable of Implication and describe the Reasons for the Validity of the Implication for each TruthValue.
3. Describe the Antecedent (A) and Consequent (C) of the following Implications. ***TBD***

24.6 Operation of Equivalence

Logical Equivalence (or "if and only if"-Statement) is an Operation that describes that an Implication occurs in both Directions of an Inference, i.e. The Premise can

[5] I admit that this is problematic to discuss but I give a try.

act as a Conclusion and vice versa. Typically in colloquial Language, the SentencePart "if and only if" implies that there is only only one Prerequisite that must be considered and that's it.

E.g. "I will marry her, if and only if get the Money", i.e. only on the Premise of getting the Money, a Person will marry his Sweetheart. This is not what logical Equivalnce is about.

In logical Inference, the same SentencePart "if and only if" implies something really different: that both Propositions can act as Premise and Conclusion by taking them at different Directions.

E.g. "**I will marry her, if and only if I get the Money**", has the Conclusion "**I will marry her**" and the Premise "**I get the Money**".

E.g. "**I get the Money if and only if I will marry her**", has the Conclusion "**I get the Money**" and the Premise "**I will marry her**" [6] .

Logical Equivalence is denoted by the "logical Equivalence"-Symbol, $\Leftrightarrow$, and grammatically is equivalent to the Sentence "if and only if".

The logical Equivalence, denotes two Implications where each Proposition changes Role to the opposite Role. Let two Implications to be equivalent for the same Propositions, that is:

$$B \Rightarrow D$$

$$D \Rightarrow B$$

If both Implications are true, then their Conjunction, is also true:

$$(B \Rightarrow D) \wedge (D \Rightarrow B) = True$$

Consequently since both Implications are Part of the same Equivalence, then their Equivalence holds. This is shown by the TruthTable of Implications and Equivalence, see 24.1.

[6] Bastard! You destroy the Girl! JOANNA I STILL LOVE YOU! DON'T MARRY HIM!

B	D	$B \Rightarrow D$	$D \Rightarrow B$	$(B \Rightarrow D) \wedge (B \Rightarrow D)$	$B \Leftrightarrow D$
F	F	T	T	T	T
F	T	T	F	F	F
T	F	F	T	F	F
T	T	T	T	T	T

Figure 24.1: The two corresponding Implications and their Equivalence.

Questions and Exercises

1. What is Equivalence?
2. Write the TruthTable for Equivalence.

Chapter 25

The scientific Method

Narrative

The **scientific Method** is Method that we use to discover the World and develop Applications. Both these Endeavors, **Discovery and Development**, are based on the Concepts provided by Science, shortly described as **Observation and Experiment**. The Description "shortly" refers only to two of many Aspects that contribute to this Endeavor!

25.1 Discovery, Development and Application

Science requires Discovery and Development, in the Sense that the Discovery of Nature can provide its Rules and later their Application to various Developments.

Discovery can be either a **Process** where we seek Knowledge, but can also be the **Result of Searching**. By Definition:

Def. 25.1.0.1*:* **Discovery:** is the FindingProcess or FindingResult of an Endeavor seeking Knowledge.

Development can either refer to the ConstructionProcess of an Item, or to the GrowthProcess of an Item once the Item changes. By Definition:

Def. 25.1.0.2*:* **Development:** is the GrowthProcess or ConstructionProcess for an Item.

Associated with Discovery and Development is the Term "Application", which is the tangible Part of Science, where an Item, whether tangible or intangible will be used to the real World. Another Use of the Term "Application" refers to the Deployment of a Discovery to the real World, typically as an Invention. By Definition:

Def. 25.1.0.3*:* **Application:** refers to the Use of a Discovery on an Item or the Deployment of an Item representing a Discovery to the real World.

E.g. A useful Application is the Discovery of TemperatureEffects on Steel, which led to different Approaches of SteelConstructions.

E.g. A useful Application is the "Light"-InsectTrap where it was discovered that ultraviolet Light can attract Insects, and an Device was developed to use this Effect.

E.g. The Discovery of Fire by Observation lead to the Discovery of Ways for creating Fire as well as Applications of Fire such as Cooking and MetalProcessing.

25.2 The Scientific Method

Science needs a way to perform Research according to her View. This particular Way is called **scientific Method**. The scientific Method is not a fixed Method

but an incomplete ToolSet that we use in innumerable Ways to discover the World and develop Applications. Method is by Definition:

Def. 25.2.0.1*:* **Method:** is the Course of Action or the Set of Actions of performing a Task.

Scientific Method is as such defined:

Def. 25.2.0.2*:* **Scientific Method:** is the Method that is used to discover the World and develop Applications and as Method is based on the Findings and Developments of Science.

Remark 25.2.0.1. The scientific Method is both a Science and Talent, since it requires existing Science as well as emotional Engagement to Practicality to deliver its Requirements.

Frequently the Term "Methodology" arrives and is confused with the Term "Method". A **Methodology** is a System of applying a Method, and as such consists of aspects that support the Method. By Definition:

Def. 25.2.0.3*:* **Methodology:** is a System that deploys a Method into the Field of Research and Development.

Consequently a scientific Methodology is:

Def. 25.2.0.4*:* **Scientific Methodology:** is a System that deploys the scientific Method to the scientific Endeavor.

The seven Aspects (I call them "Pylons") of the scientific Methodology are:

- Observation
- Logical Inference
- Hypothesis
- Experiment
- Proof
- Development
- Application

The seven Pylons are not just separate Terms: they enclose a Multitude of minor Terms that help to organize the Research. Next I will provide the Definitions of Terms.

25.2.1 Observation and logical Inference

Until now, I have wrote elsewhere in this Book about Observation and logical Inference.

Observation can be done physically, i.e. you are present in a Phenomenon and you observe it, or it can be done mentally either by visualizing a Phenomenon or performing a logical Inference on reliable Data.

Logical Inference concerns the Collection and Connection of Propositions and Arguments to form the Argument we want to prove.

25.2.2 Hypothesis

Since Science didn't start from nothing, I will assume that Observation was the first Thing that the Humans deployed to satisfy their Curiosity. Later the Concept of Hypothesis arrived to formulate the Assumptions based on Facts. Hypothesis is the Greek Word for "Assumption" and due to its Distribution in ancient Greek Texts on Mathematics and Geometry, as Term became Synonymous with the Assumption based on Facts. I define it as a Concept that we assume that has a valid Value since it is based on Facts; whether is plausible, this can only be answered by the Validity of the Facts that we use to construct it. By Definition:

Def. 25.2.2.1*:* **Hypothesis, De. Hypothese, ἡ ὑπόθεσις:** is the unproven Concept based on Facts.

Typically a Scientist studies a Phenomenon and will eventually compile a List of Observations to the Phenomenon.

From this List, he will derive known and unknown Information about the Phenomenon. For the unknown Parts of the Phenomenon he will compile a List of Hypotheses (Plural for Hypothesis) based on actual, plausible Data and Processes. Each Hypothesis will contain Propositions that are true and are supported by Science. These Propositions are the Premises for his Hypothesis, while his Hypothesis is the Conclusion for these Premises [1] .

E.g. Phenomonen of Ghost.

Argument 1: Phenomenon of a Ghost

- Pr1:="The Ghost interacted with the Witnesses as a Vision"=True.
- Pr2:="None of the Witnesses were under Influence of mental Stress, Medication, Alcohol or recreational Drugs"=True.
- Pr3:="None of the Witnesses have any criminal Record or any known unreliable Reputation that will contain the Malice of the Witness to lie"=True.
- Conc:="There is a Phenomenon of Ghost in an Area which is witnessed by Persons."

Argument 2: Presence of electric Field into the Area where the Ghost appeared

- Pr1:="The Witnesses asserted that the Area was electrified before the Encounter with the Ghost"=True
- Pr2:="The Area where the Ghost appeared is always electrified"=True. The Area was measured and found to contain high Charge.
- Pr3:="The Space can contain an electric Field"=True. This Premise is supported by the Bibliography provided by the accepted academic Authorities on the Science of Physics.
- Pr4:="An electric Field can be sensed by a Person due to the Presence of static Electricity"=True. This Premise is supported by the Bibliography provided by the accepted academic Authorities on the Science of Medical Electronics as well as Biology.
- Conc:="The Ghost appeared in the Area with electric Field"=True.

Derived Hypothesis from Arguments 1, 2:="There is Evidence of Association of GhostAppearance in an Area with electric Field".

25.2.3 Experiment and Stimulation

An **Experiment** is an Operation where a Phenomenon is investigated by applying a Stimulus to a System that represents the Phenomenon and observing the Results of the Stimulus (i.e. the **Response**; the Response provides the Data) in a controlled System (AKA "controlled Environment"). Though many Experiments do not require Stimulus, the Setup of an Experiment can be considered the ultimate Stimulus since it provides the Configuration for the Phenomenon to happen. By Considering the Phenomenon itself, we can either create the Prerequisites for a known Phenomenon to happen or we can even create ourselves a new Phenomenon (intentionally or not) by accessing the Prerequisites for it. By Definition:

Def. 25.2.3.1*:* **Experiment:** is an Operation, within a controlled Environment, used to extract Data by Creation of a Phenomenon and Application on it of Stimulus so that the Response of the Experiment provides the Data.

The Experiment brings the System to the *State of Excitation.* **Excitation**, in

[1] Here I have very roughly denoted the Construction of Premise and Conclusion as well as their Evaluations. Inside the Bibliography on Logic, the Books ***TBD*** provide the Methods for the correct construction of Arguments in general. I hope later in my Life to write a firm Introduction to the philosophical Logic.

it's most fundamental Form, is the Operation that "triggers" the System to react. By Definition:

Def. 25.2.3.2*:* **Excitation:** is the Operation that causes a System to React.

When the System is under Excitation, we say that the *System is under Stimulation*, that is, the System is in a *State of Reaction*. **Stimulation** is defined as:

Def. 25.2.3.3*:* **Stimulation:** is the SystemState where the System reacts.

Excitation provides the System with Stimulus, that is, an external Input provides a Cause for the System to react. **Stimulus** is defined as:

Def. 25.2.3.4*:* **Stimulus:** is called the Application of a Signal to a System.

The System reacts to Stimulus by producing a **Response** which is detected by the Tools of scientific Method. Response is defined as:

Def. 25.2.3.5*:* **Response:** is called the SystemReaction to Stimulus.

Associated with Experiment is the *Concept of Test*. While an Experiment provides the Data of a Phenomenon, the Test examines the Validity of an Event or Item that can be used for a particular Purpose, typically but not exclusive, Engineering.

Def. 25.2.3.6*:* **Test:** is the Process of validating an Event or Item under Examination for using it for a particular Purpose. [2]

While the Term "Test" concerns a Process, the Term "Testing" is almost synonymous with "Test"; sometimes the Term "Testing" concerns a general Set of Tests concerning an Item.

Since the Terms "Test" and "Experiment" are now defined, a Need arises on the Term "Trial". For most of our Purposes, a Trial is a Test where an Item is examined for its Performance. Placing on "Perspective", while the Experiment examines the Existence of a Property, the Test examines the Validity of an Item to exert this Property and the Trial examines the Performance of an Item concerning the Exertion of this Property.

Trial is defined as:

Def. 25.2.3.7*:* **Trial:** is a Test that examines the Performance of an Item.

25.2.4 Proof

Proof is called the Description of Validity of a Claim and consists of many Arguments that validate or invalidate an Assumption. By Definition:

Def. 25.2.4.1*:* **Proof:** is called an Argument that describes the Validity of a Proposition.

Proofs are fundamental in Science since valid Propositions build new Concepts and Ideas that contribute and expand Science.

The Proof takes its Data by valid Arguments, Experiments, Trials and Tests and provides new valid Arguments. In this Sense, the Proof expands the Science. Every scientific Field demands Proofs and each one has its own standard Procedures to obtain Proofs.

25.2.5 Development

I spoke already on Development. Concerning the scientific Method, the Development uses the all of the previous Concepts (Observation, logical Inference, Hypothesis, Experiment and Proof) to construct or further enhance an Item. Concerning actual Construction, while Physics provides the internal Mechanisms of Nature on Phenomena, it is Engineering that provides the Development of new Products.

[2] The Term "Test" is according to [Skeat] attributed to the alchemical Pot where Gold was judged by the Alchemist.

25.2.6 Application

I have also described previously the Term "Application" as the Use on an Item or Deployment of an Item representing a Discovery. Concerning the scientific Method this is the last Task.

If you understand the Impact of a Phenomenon in the real World, you can further consider the Implications of this Impact, and this is the Use, i.e. Application of that Impact. In Addition, if you can actually create an Item which uses the Mechanisms of Phenomenon and then you deploy this Item, then you create an Application for this Phenomenon.

Chapter 26

Model

26.1 Narrative

A Model is an Abstraction that helps to define the View of an Idea or Product by using the least Information available. As such, the Model provides only the necessary Functionality and is simple to investigate. The Implementation of a Model is called "Prototype" and is used to examine the Functionality of a Product based on practical Issues related to the Production, its Cost and eventually the Satisfaction of the Customer.

In this Chapter I will go examine the Model and its various Concepts relating to it.

26.2 Concept, Notion and Intellect

Until now, the Word "Concept" was left undefined but colloquially used, in the Sense of a vague "Idea" as in the Sentence, "a Concept is a vague Idea". I will define it as a specialized Notion:

Def. 26.2.0.1*:* **Concept:** is a specialized Notion about an Object of Matter.

As such, a Concept provides a Framework about a Notion, where the Notion can be established based on the Support that the Framework provides.

E.g. Thinking of the Term "CorrectionFacility", we might consider the Idea of a DetentionFacility known as "Prison". By using the Term "Concept" we can derive the "Concept of a CorrectionFacility" which might or might not describe the Detention of the Persons; as such, we can start to build a Set of very specialized Notions about what constitutes a CorrectionFacility, such as:

- A Facility that trains Persons to Work
- The Facility contains a medical Area for "first Aid" as well as Rehabilitation of injured Persons
- An Area for Meditation
- An Area for control of the Facility etc.

Speaking of Notion, this is a general Idea that a Person can get by studying an Object of Matter,

Def. 26.2.0.2*:* **Notion:** is an general Idea by studying an Object of Matter.

Finally the Intellect is an Ability that a Person or Animal has to perform Thinking and understand from it. By Definition:

Def. 26.2.0.3*:* **Intellect:** is an Ability of any living Being to form ThoughtStructures and derive from them Understanding.

26.3 Model

A **mental Device** is a Idea that we have in our Mind about something. It is defined as:

Def. 26.3.0.1*:* **Mental Device:** is a Idea constructed in our Mind and serves the Replication of Reality into our Mind for ResearchReasons.

The Mental Device does not conform to Reality, only it helps its Comprehension. *It obviously cannot be modeled unless the Model ignores all Aspects of Reality which is impossible.* Consequently a Mental Device assists the ModelCreation, but is not the Model itself. The mental Device is not a Concept, but it derives from a Concept.

An Example of a mental Device is the Concept of a Prison. It contains the Requirements of:

- Keep the Detainees away from the Public.
- Keep the Detainees safe from themselves.
- Make the Detainees safe for the Public upon Release from their PrisonSentence.

While the first Item is completely served by a Prison, the next Item are impossible to create but you can approximate them with some internal Processes that will affect the Prisoners.

Typically when you start to write about a Concept, practically speaking, you write a mental Device. If you not feel comfortable with this Detail, just write "Concept" and everyone will understand what you are speaking about [1] .

A **Model** is a mental Device used to provide a simplified View to the **internal Aspects and Mechanisms of a Phenomenon or a RequirementsSet for Product**. As a Representation, it realizes the Abstraction which itself derives from the Investigation of a Concept, and serves as a List of Requirements to help the ModelBuilding.

E.g. By Investigation of the Concept of a Car, we get the Abstraction of a Car, as a Vehicle that has the following (incomplete) Properties:

- It transports Passengers and Goods
- It moves mostly on Roads
- It provides Shelter from the atmospheric Phenomena.

While these are the Properties, we can consider them now as Requirements that a Model needs to exert. Whether the Car will have wheels, this is Part of the Technology we need to consider.

But a Model is something more: it does not simple defines the Properties as the Requirements ask, but it also defines the "Context of the Concept under Scrutiny", not the whole of the perceived Reality. Consequently a Model is simple, understandable and quick to represent the Context.

E.g. The Model of a Car must consider the Context of deploying the Car in a City. As such, it must put into Consideration the Aspects of Legislation, Integration of the Car into the CitySystems etc.

I define Model as:

Def. 26.3.0.2*:* **Model:** is an incomplete Expression of an Abstraction, restricted to the bare Functionality of the Abstraction.

A Model can be **tangible** (a Thing you can touch, a model of an aircraft) or **intangible** (a Thing that you can hold in your Mind and describe in Paper or other CommunicationMedium. E.g. a ComputerProgram E.g a philosophical Idea).

The Act of Creation of a Model is called "Modeling"

Def. 26.3.0.3*:* **Modeling:** is the process to create a model.

[1] Don't be scared when an Author writes Details! He writes what is available, not necessary what is needed. Just do your Job and eventually you can add more Details at the End. A Bottle of Rum is surely a great Companion for this Effort.

26.4 ModelImplementation

Models need to be Implemented. The Implementation of a Model is a Process on its own right ant takes a TimeDuration. In addition, and since we are dealing with a Model, the Model should contain only the necessary Items that requires to be functional according to our Specification. By Definition:

Def. 26.4.0.1*:* **ModelImplementation:** is called the Realization of the Model with the least functional Requirements.

Verb: implement.

A critical Aspect of the Model is how much detailfull is. Here the available Resources (Money, HumanIntellect, Functionality, Time) to build the Model test their physical Limit; you cannot have a very detailfull Model without to trade your Resources, i.e. the more Details, the more the Model costs.

The DetailLevel is the Amount of Details as well as the Amount of Functionalities the Model exerts. I define it as:

Def. 26.4.0.2*:* **DetailLevel:** is the Magnitude of Detail added in a Structure.

The finer the Detail, the higher the DetailLevel.

Sometimes a Model need to be tangible. In this Case, you can create a Prototype, this is a Device that actually implement the Model. The Prototype provides a deep Insight to the Model and can add practical Information to the Model. By Definition:

Def. 26.4.0.3*:* **Prototype:** is the implemented Model as a tangible Item for Use in the Functionality-, Operability- and PerformanceResearch of the Model.

A Model can have more than one Prototypes, where each Prototype investigates particular Facets of the Model.

Chapter 27

The administrative Parts of scientific Method

Narrative

Theory. **Lemma**. **Proof**.

These are some of the Words that put a Terror in the Face of the scientific Reader. In Reality, these Terms are *simple administrative Terms* that are used to denote the *Aspects of the scientific Endeavor*. You can consider them as Milestones to the Journey. Where to start and where to finish with them? Here I provide also a small Narrative to the *most common Terms*, along with their Definitions.

The Idea that the Terms and scientific Method delivers, is that the Concepts provided by any Research, can eventually attach to the Body of Knowledge. If you are a Student, these Terms are actually minor into your academic Education. Once however you are in the "Wild", you can begin yourself to build and organize your Knowledge with these Terms.

An important Notice: The mathematical Logic is very much concerned with these Terms. An **Excellent Definition** of these Terms within the mathematical Logic are provided by [Cook].

However the personal History of these Terms is much more sad than what they Eye meets. As I attempted to model a Patent back in 2009 I discovered that my Knowledge of Physics and consequently of Mathematics was very primitive. Returning to the Books of mathematical Analysis in order to get a proper Foundation on embarking to the Study of Vorticity, I realized that many Terms of Mathematics and Science were either abused or misused. As an Idiot myself I thought that this was due to my mental Incapacity as well as Depression. The Solution to these Terms came by studying original mathematical Resources and their Use which brought up the Terms. These are provided for Comparison in Bibliography. I hope one Day to go back to University to study Language as well as Mathematics, just in order to get the View of Mathematicians as well as test some Ideas that I have in Mind long ago.

27.1 Clarity, Example and BackReference in a Text

A Book contains References to new Information or References to already mentioned Information. The latter is denoted as "ibid" and is an Adverb.

Def. 27.1.0.1*:* **ibid:** is the Adverb used in Documentation to refer to something directly previously mentioned.

E.g. **Note 1:** This is found in [Mark]. (On the next Page) **Note 2:** Ibid.

Here the "Ibid", refers to the previous

Author, Mark.

Sometimes a Clarification of a Name needs to be made. The Abbreviation "**i.e.**" is used.

Def. 27.1.0.2*:* **i.e.:** means "id est", in Latin, "that is", is a Clarification for a Name, Term or Sentence that needs to be made.

E.g. Tim, i.e. the DrugDealer that provides Coke to the Parliament, is dead.

When an Example appears in a Text, then the Abbreviation "e.g." is used.

Def. 27.1.0.3*:* **e.g.:** means *exempli gratia*, meaning "for example" in Latin.

This is an Example:

E.g. The people that buy.

27.2 Proclamation

A Proclamation is any official Announcement that concerns a scientific Endeavor. In Science there are various Types of Proclamations and these are:

- Sciences
- Disciplines
- Propositions
- Definitions
- Hypotheses
- Criteria
- Axioms
- Postulates
- Rules
- Laws
- Principles
- Conjectures
- Theories
- Theorems
- Corollaries
- Lemmata
- Proofs
- Remarks
- Notes

Typically the Sciences and Disciplines are not proclaimed but appeared after a StandardizationEffort from a Group of Administrators that declare a new educational Course or a Scientist is interviewed by a Group of Scientists about his Effort. Thus only the last Items are Proclamations.

By Definition:

Def. 27.2.0.1*:* **Proclamation:** is a formal Announcement about an Event or Item

27.3 Axiom and Postulate

[1]

It all starts with the **Idea**. You observe a certain Behavior and you get a certain Idea about it. Imagine a primitive Person having in his Hand a Fork without any Knowledge about its Purpose; this Item might or might not represent something in his Experience. However he has some Ideas about the Item, simple by touching it (its metallic, it can be grabbed with one Hand, it seems to fit on the Hand etc.).

[1] This Section contains a Narrative about the scientific Method, but this Narrative will serve to define the important Terms of "Axiom" and "Postulate", as well as their ConfusionPoint. The first Terms, in this Narrative have already being described in the previous Chapters. A Clarification: Because of a Differences in original Translation of GreekTerms to Latin Terms, as well as different Developments in mathematical Endeavors, there is a certain Divergence of the Terms "Postulate" and "Axiom". This Divergence it will become apparent in the [Grolier], [James] and [Weisstein] Definitions. Apparently in Academia there is a certain Confusion about the Use of the Terms, but I will not go to mention Names or further perform Research on it.

The Idea gives rise to a **Concept** which is an extended and fixed Idea; the **Concept** is of higher value of the Idea, since it contains a certain clarity. The Concept is based on one or more Expressions in the Mind of the Thinker. An **Expression** is a Sentence defining the Concept. A formal Expression is called a **Declaration** and is used frequently in Science as a formal way to materialize the Concept in Form of **Statements**; in this Sense a **Statement** is a declarative Expression or Declaration [2] .

In Science, of particular Importance are Statements with Clarity of Outcome. A **Proposition** is a Statement that can be either true or false. E.g. "Paris is the Capital of France" is a Proposition concerning the City of Paris, and asserts that Paris is the capital City of France: as a Proposition, this Statement has only true or false Value.

Speaking of Propositions and Concepts, a **Postulate** is a suggested Concept that can help the scientific Development. E.g. the Concept of three Dimensions is a Postulate that can help with the creation of Relations concerning the Motion in empty Space. A similar Term to "Postulate" is "Axiom". **Axiom** is a proofless Statement and also serves as a BuildingBlock for the scientific Development. E.g. "There are always Stabbings in London". And here is the Confusion: in scientific Literature is unfortunate that "Axiom" is considered a synonym for "Postulate". I make here a Distinction and add this as Clarification: **Postulate** *is* a not-exact Statement of a Concept and **Axiom** *is regarded* as an exact Statement of a Concept.

Def. 27.3.0.1*:* **Postulate:** is a suggested and plausible Concept that can help the scientific Development.

Def. 27.3.0.2*:* **Axiom:** is a proofless Statement used for deriving a scientific Result.

27.3.1 Comparison of Terms "Axiom" and "Postulate"

The Definitions of Axiom from all Authors are more or less convergent besides the Distinction offered by [Grolier], in Particular, that Postulate refers to a Specialization and Axiom refers to a Generalization.

Axiom: In ancient philosophy, an axiom, from the Greek meaning "thought to be worthy of," was a starting point that needed no evidence or demonstration...Axioms were assumed to be self-evident and necessarily true...Aristotle applied the term to certain propositions that he claimed were self-evident...Axiom is often used interchangeably with postulate. However, axiom usually refers to a basic proposition common to many or all subjects, whereas postulate refers to a basic proposition in a specific field [Grolier].

Axiom: A statement that is accepted without proof. The axioms of a mathematical system are the basic propositions from which all other propositions can be derived. [James]

Axiom: A proposition regarded as self-evidently TRUE without PROOF. The word "Axiom" is a slightly archaic synonym for POSTULATE. [Weinstein

Axiom: A proposition assumed to be true, or considered self-evident, and used as a basis for logical deduction. [Lord]

Postulate: See AXIOM [Grolier]

Postulate: See AXIOM [James]

Postulate:A statement, also known as an axiom, which is taken to be true without proof. [Weisstein]

Postulate: No Entry[Lord]

Questions

[2] Here I redeclared the Term "Statement" without to diverge from the original Term. The Reasoning behind is simple: to connect the Term "Declaration" and "Statement" since they have very intimate Relation concerning computational sciences

1. What is “Postulate”?
2. What is “Axiom”?

27.4 Rule, Law and Principle

There are some Issues concerning the “Tidiness” of the scientific Endeavor, and these Issues have a regulatory Value. These are the Regulations that Nature imposes to the Mechanisms of the Universe and concern the Terms “Rule”, “Law” and “Principle”. These Terms have been obtained by the Administration of People, and relate to both public and private Administration. As such are defined:

Def. 27.4.0.1*:* **Rule (Administration):** is an Instruction of performing an Act.

Def. 27.4.0.2*:* **Law (Administration):** is a Command by an Authority to obey an Act or Behavior.

Def. 27.4.0.3*:* **Principle (Administration):** is a fundamental Way to control something.

In Addition, the Term “Principle” has an ethical Definition:

Def. 27.4.0.4*:* **Principle (Philosophy):** is a fundamental Way of HumanBehavior.

While these Definitions are can serve very well Science, its the Nature of Science to have a more strict Description of these Terms, typically described by the Word “scientific”. By Description:

A **(scientific) Rule** is a basic Operation.

E.g. “Don’t feed the Doves”.

A **(scientific) Law** is an extended (i.e. generalized) RuleForm [3] that is always valid within the Context that it supports.

E.g. “Don’t feed wild Animals”.

Remark 27.4.0.1. A Rule or a Law might not enclose the Consequences that their Neglect may cause or the Requirements that lead to the Inception of the Rule or Law.

E.g. You might find a Law “Do not lie”, but the law will probably not narrate the Consequences (i.e. Crime) or the Requirement for the Creation of that Law (i.e. to keep public Trust between the SocietyMembers).

Together with Rules and Laws come the “Principles”.

A **(scientific) Principle** is a fundamental Law, Rule or Aspect that is always valid within the Context that it supports.

Remark 27.4.0.2. Please consider “Principle” as a higher level Rule, in Terms of Respect that you must Honor.

.

E.g. The Principle of the least Action. This Principle implies that a System will use the lowest Requirement in Energy to perform its Task [4] .

E.g. **Newton’s third Law** [5] states the *ReactionPrinciple*: “for every Action there is an equal and opposite Reaction”. The Consequence of ReactionPrinciple is the Question (which leads to another scientific Endeavor): “what are the reacting Forces when a Body hits another”. The Clarification is the following: There is a generalized Rule (i.e. a Law), called “Newton’s third Law”, and concerns the fundamental Law (i.e. a Principle) called “Principle of Reaction”, AKA “ReactionPrinciple”.

[3] The “Law” is a short for“ Law of Nature”. The “Law” is verified only if an Experiment confirm the Existence of the “Law”. The Experiment must be able to duplicate the Existence of the “Law” in every Aspect required.

[4] E.g. I am thinking a public Servant ☺.

[5] In his Work, Newton uses the Terms “Axioms” or “Laws of Motion” for the three Laws of Motion. In the School and University I learned his Laws as “*Principles of Motion*”, instead of “Laws of Motion” (he included also the word “Axioms of Motion” which was the original Translation from Latin). The administrative Terms here, can be regarded by many unnecessary and thus can be taken as they are encountered from the Author that you encounter.

In Mathematics, the term "Principle" may enclose also Theorems (later!), Postulates and Definitions.

Remark 27.4.0.3. Principles and Laws are always proven.

Def. 27.4.0.5*:* **Scientific Rule AKA Rule:** is a basic Operation.

Def. 27.4.0.6*:* **Scientific Law AKA Law:** is an extended RuleForm that is always valid within the Context that it supports.

Def. 27.4.0.7*:* **Scientific Principle AKA Principle:** is a fundamental Law, Rule or Aspect that is always valid within the Context that it supports.

The Terms Postulate, Principle, Rule, Axiom and Law are often mixed up in Texts to denote the same things. To avoid Problems, always keep a current scientific Dictionary available. When you have such a Dictionary, "Wonders" will occur: you will get Friends, Girlfriends, a Goat as a Present from the Priest of the Neighborhood, free Drugs from the Pharmacist, Money from the Postman, even a nice Prostitute from the Leader of your local Cartel!

Questions

1. What is "Rule" in Science?
2. What is "Law" in Science?
3. What is "Principle" in Science?

27.5 Belief, Assumption, Hypothesis, Speculation and Conjecture

When someone builds an Argument based on scientific Methods, he must use rigid Terms and Processes in order to supply the Proof of his Research. Here I will provide a Clarification on the Terms "Belief", "Assumption", "Hypothesis", as well as the Definition of Conjecture.

When we have Belief, we accept our Understanding of our Environment as a Fact. However, we don't have a Fact to support our Belief; Belief is empty of Proof.

Sometimes when we want to solve something we are lucking Data and consequently Assumptions must be made about the Existence and Nature of certain Data. An **Assumption** is a proofless Belief that is used to qualify a Prerequisite. While the Assumption is a Belief, in Science we use a Hypothesis to build an Argument. The Hypothesis is an unproven Concept based on Facts. Associated with Hypothesis is the Term "Conjecture" which in Mathematics is used as a Synonymous, [Weinstein] agrees on that, I don't. I give here my Definition as:

Def. 27.5.0.1*:* **Conjecture:** is the mental Activity where Premises are obtained by valid Anticipation based on Luck of Evidence.

In Comparison, I defined previously Speculation as *the mental Activity where Premises are obtained by* ***valid Anticipation and Belief*** *both based on Luck of Evidence.* In other Words, what separates Speculation form Conjecture is Belief.

As a Scientist, you must provide Conjectures about your Arguments, not Speculations.

27.6 Theory

In a previous Chapter I defined **Science** as *the systematic Study of Behavior of the physical World as well as of the Applications of physical Phenomena.* Since any Science is divided into Parts, called "scientific Disciplines", it is now the Moment to understand how these Parts are formed.

The Parts of Science are formed by Creation and Organization of Theories.

Def. 27.6.0.1*:* **Theory:** is a Collection of valid Arguments and valid Propositions about any Discipline and concerns a View on a Phenomenon or Set of Phenomena related to the Discipline.

E.g. Theory of mathematical Relations, Theory of Heat, Theory of Aesthetics etc.

Remark 27.6.0.1. The Theory attempts to integrate all of the Findings in such a Manner that a minimum Set of Principles and Laws is discovered and can model the Findings into the nearest Estimation.

Having described Theory, I will go now deeper into the Consequences of the Statements that I described.

The Sentence "**Collection of valid Arguments and valid Propositions about any Discipline**" concerns that we are grouping a Set of verified Arguments, as well as verified Sentences about a particular Subject of Study. Obviously During your Study, you will be assigned to investigate something and you will get many valid as well as invalid Sentences and Arguments: your Task is to collect what is valid and concern your Discipline.

The Sentence "View on a Phenomenon or Set of Phenomena related to the Discipline" refers that you must only investigate a particular View on something, this something is called "Phenomenon", and investigate it with your Capabilities, i.e. the Discipline you now own.

The Sentence "Theory attempts to integrate all of the Findings in such a Manner that a minimum Set of Principles and Laws" simple means that everything you found must pass together (integrate) such as you infer fundamental and simple Laws that the Findings obey.

The Sentence "a minimum Set of Principles and Laws is discovered and can model the Findings into the nearest Estimation" refers that the Laws you found can be deployed to verify your Findings, i.e. the Laws can be used to create a Model of what you conceptualize, the Model should be accurate or at least approximate to the Finding you got ("nearest Estimation").

A useful Discussion about Theory is given in Chapter 6 of [Campbell] which I provide the Definition here for Comparison: "A **theory** is defined by means of the formal nature and connection of the propositions of which it consists, namely an hypothesis, making assertions about hypothetical ideas characteristic of the theory, and a dictionary, relating these ideas to the concepts of the laws explained by the theory."

Concerning the valid Arguments and Propositions within a Theory, there is a whole List of Items that belong to a Theory: these are actually all the Proclamations and more. In other Words:

Remark 27.6.0.2. Anything that can be formulated by the scientific Method and is used by the Theory, is Part of Theory.

27.7 Theorem, Lemma and Corollary

A Theorem is a proven Statement that has a fundamental Role within a Theory, as it is a generalized and fundamental Proposition. We don´t need to prove it, we just know its existence and use it. By Definition:

Def. 27.7.0.1*:* **Theorem:** is a Proposition that is proven by Use of the scientific Method and is used or regarded as a Principle.

E.g. Theorem of Bayes, Theorem of Jacobi etc.

Typically when you are involved in pure Research in a scientific Endeavor, you might encounter and perhaps formulate a Theorem.

Closely associated with the Term "Theorem" are the Terms "Corollary" and "Lemma".

A **Corollary** is a Proposition directly derived from a Theorem and is considered a specialization of the Theorem. Sometimes "Corollary" is used as a Specialization of a Law or Conclusion. By Definition:

Def. 27.7.0.2*:* **Corrolary:** is a Specialization of a Theorem and is directly derived from a Theorem.

A **Lemma** is a Theorem that forms the Base of Proof for another Theorem. As such, any existing Theorem can be used as a Lemma and consequently it will declared during Research as a Lemma.

Def. 27.7.0.3*:* **Lemma:** is a Theorem used to prove another Theorem.

27.8 Criterion

Criterion or (rarely) Criterium is a Prerequisite for a Proposition to be valid. As such it is also called "Condition". Since I have a psychological Problem with this Word, since it can mean "State" as well as "Prerequisite", I try to avoid its Use as a Descriptor of an Antecedent for keeping Clarity and Sanity (which so much I am in Need). By Definition:

Def. 27.8.0.1*:* **Criterion AKA Criterium:** is called a Prerequisite for a Proposition to be valid.

The Use of Criterion is to impose a Constraint to the generated Theorem so that a careful Description can arise.

27.9 Scientific Literature

The Term "Literature" is associated with artistic Writing, i.e. Fictional or dramatized real Stories, such as Roger Zelazny's "Lord of Light".

In Academia, the Term "Literature" can refer to published scientific Findings ("Papers") or academic Books and Journals as well as Manuals. By Definition:

Def. 27.9.0.1*:* **Scientific literature:** is called everything that is published for scientific Growth and Review. Typically these are Studies, Observations, Data and Experiments, academic Books, academic Journals and Manuals.

The Scientist access this Literature by any available Supplier or Library. Some Publishers provide also scientific Journals such as Elsevier and CRC Press.

Another important Issue is the one of Nomenclature. Nomenclature is a Way to appropriately name various Aspects of Research concerning a Discipline or Science. By Definition.

Def. 27.9.0.2*:* **Nomenclature:** is called a System of naming the Terms used in a stated Discipline or Science.

E.g. The Science of Chemistry uses special Names to define Compounds of chemical Elements, i.e. Compounds with one two three four CarbonAtoms get the Prefixes "Meth-", "Eth-" such as Methane, Ethanol, etc.

Finally an important Aspect is to refer precisely your Source. A Citation is a Reference to an InformationSource where the Scientist refers to his Data.

Def. 27.9.0.3*:* **Citation:** is a Reference to an InformationSource where the Scientist refers to his Data.

The Citations are included in a Section of your Work called either "Resources", "References", "Citations", "Bibliography".

In this *Collector of my Tears* (I mean my Book, you Idiots!), I have used what is now known as the IEEE System, see [Alred et al]. In this System of Citation, the following Informations are compiled as such:

- Brackets containing the Surname of the Author. If many Authors are available, then Either the Name of the Editor of the InformationSource or the Name of the first Person mentioned is added followed by the SentencePart "et Al", which means the all the Rest.
- After the Name in Brackets follows a Colon as a Declarator.
- The Surname of the Author, followed by his first Name. For Many Authors, use a Comma for each Author. The last Author, is followed by a Dot (grammatical Period).
- The Title of the Book follows and closes with a Dot.
- The PublisherName, then the PrintingLocation, then the Country of Publisher and finally the PrintingYear, followed by a Dot.

E.g. In a Paragraph is written : "This Ideas are found in [Ellis et al]". Later in a Section called "Bibliography", the Citation appears as:

[Ellis et al]: Ellis Aaron, Sonja Sechsi. Success in Robberies: Advanced Techniques for the inspiring Criminal. Mythical Criminal Press, New York, USA, 2062 [6] .

Sometimes, especially in complex Text, you might need to add the PageNumber as a complete Reference. In this Case, you can add into the Brackets a Comma, followed by the PageNumber, as e.g. [Ellis et al, P.12].

[6] This Book, or the Authors or the Publishers do not exist! I will even speculate that any other Reader except of me does not exist. Perhaps even is very possible that my Book or even me does not exist.

27.10 Bibliography

- `[Campbell]`: Campbell, Norman Robert. Physics The Elements. Cambridge University Press, London, UK, 1920
- `[Cook]`: Cook, Roy, T. A dictionary of philosophical Logic. Edinburgh University Press, Edinburgh, Scotland, 2009.
- `[Alred et al]`: Gerald J. Alred, Charles T. Brusaw, Walter E. Oliu. Handbook of Technical Writing. Bedford/St. Martin's Publishers, Boston, USA, 2012.
- `[Grolier]` Various. Encyclopedia of Knowledge. Grolier Incorporated, USA, 1991.
- `[Lord]`: Lord, M.P. The MacMillan dictionary of physics. MacMillan Press, London, Britain, 1986.
- `[Weinstein]`: Weinstein, CRC Concise Encyclopedia of Mathematics]
- `[James]`: James, Robert. Dictionary of Mathematics. Chapman and Hall, NY, USA, 1992.

27.11 Bibliography for mathematical and scientific Nomenclature (Original Resources)

The Bibliography provided has a Date that was intentionally ranged as the End of 1800. This is due to the Transition of Mathematics from its applied Domain to the theoretical and formal Domain at this Time. Since the Mathematicians of this Time survived the pure Mathematics, this is in my Opinion due to the great Foundations they had. The Books referred were not read in whole! Instead some of their Aspects containing the Terms were read and compared and not only including the Definitions but also the Mathematics that were associated with the Terms. Future Checks of these Books with my

Definitions will denote any possible Conflict, new Ideas or unintentional Plagiarism from my Side; such a Check should also include other Resources that I indicate elsewhere in this Book and should be a joint Effort of professional Reviewers and an artificial IntelligenceSystem.

- `[Atkins]`: Atkins, Edward. Pure Mathematics. William Collins and Sons, London, Britain, 1877.
- `[Ficklin]`: Ficklin, Joseph. Complete Algebra. Ivison, Blakeman and Company, USA, 1875.
- `[Olney]`: Olney, Edward. A university algebra. Sheldon and Company, NY, USA, 1885.
- `[Jevons et al]`: Jevons, Stanley, Hill David. The Elements of Logic. Sheldon and Company, NY, USA, 1883.
- `[Johnson]`: Johnson, W.,E. Logic Part 1. Cambridge University Press, London, Britain, 1921.

Chapter 28

Artificial Intelligence

Narrative

The Purpose of this Section to describe the Technologies of artificial Intelligence and their Impact.

I did study Mechatronics and ControlSystems, with Mechatronics be an EngineeringDiscipline and ControlSystems a PhysicsDiscipline tailored to Engineering. Both these Disciplines have only a rather primitive View of a System in Terms of Sensing, DataManipulation and Response. Consequently I shouldn't be considered an "theoretical Computing"-Scientist, a Psychologist, a Neuroscientist, or a cognitive Scientist; while I have read and somewhat studied these Disciplines and Sciences, I don't have any Qualification on them, consequently this is the Opinion of "Joe the Plumber" who speaks on Issues and at the same Time, repairs the Pipes [1] .

A Catalog of Books that I read, on the Issue discussed, I provide at the Bibliography.

28.1 Artificial Intelligence

Before I speak on artificial Intelligence I include the DictionaryTerms for Intelligence. These are:

Intelligence n. *A set of abilities to adapt better to the environment through experience. The nature of these abilities is much debated in psychology. Most intelligence tests include verbal abilities, quantitative reasoning, memory capacity, and problem solving.* ***Sternberg's theory*** *supposes that there are three kinds of intelligence: analytical intelligence, which helps one do well with academic issues; a creative aspect, which is related to dealing with novelty and inductive reasoning; and a practical aspect, which is related to adapting to the demands of everyday life.* [Matsumoto et al].

Intelligence: *according to* ***Thorndike*** *(1903) a multitude of independent capacities, some of which are sampled by tests of intelligence; but, according to* ***Spearman*** *(1904), a common capacity (or group of capacities) underlying, in greater or lesser amounts, specific activities. In 1909,* ***Binet*** *wrote that intelligence involves the ability to maintain a direction, adaptability, and auto-criticism. Subsequently, many other psychologists have proposed other definitions none of which has been completely accepted.* [Harriman].

I define Intelligence based on these Definitions, my own EngineeringExperience as well as Books that I studied, as:

Def. 28.1.0.1*:* **Intelligence:** is am autonomous System of mostly uncategorized interacting Abilities that act synergistic as well antagonistic to each other, and allow an Entity to learn through Experience, to

[1] Hey Joe, enough with FootBall, tell me something about discrete FourierTransform! (WTF?)

adapt to new Stimuli, to perform Judgment to current Stimuli and exhibit Creativity for enhancing the Survivability to dynamically changing Demands.

Concerning my Definition, I have defined **"Ability"** elsewhere in this Book as *the owned Competence*. An **uncategorized Ability** is the one that contains more than one Property or it contains a Property of not clear Ownership by a Subsystem [2] and consequently is shared by more than one Subsystem. I consider this as a probable Situation since the Researchers of Intelligence do not have currently a clear View of which Properties are involved, i.e. there is no clear Consensus, but at least they have noted Patterns of PropertyExpression in Intelligence. These Abilities act together either by competing to each other with the most expressive to act, otherwise they act together in Cooperation and beyond their Capacity. The Term **"Capacity"** I define it as:

Def. 28.1.0.2*:* **Capacity:** is called the CapabilityProperty, that is the Property of holding a Competence.

While I defined **Capability** as *the hold Competence, the Competence that something does not own, but is able to exhibit.*

As such I consider a System of cooperating Abilities will reach further than their individual Competences together, this is why the Term **"synergistic"**. The Abilities act together by facing a new Stimuli whether this Stimuli is a Sense (a tangible Item) or a Challenge (an intangible Item). The Abilities interact together as Part of a System as well as Part of their Configuration as a Subsystem that has the Purpose to provide Autonomy to the System which they are Part. Their Function as a Whole is according to my View to accumulate Knowledge through Experience, use this Knowledge as a Mean to adapt to new Stimuli, whether tangible or intangible and then to perform Operations based on previous Knowledge, what is called **"Judgment"** as well as create an Emergence of new Responses, what I call **"Creativity"** for enhancing the Autonomy of the System, what I call **"Survivability"** to a dynamically changing Environment that imposes similar Demands.

[2] Is the Ability to love an Expression of evolutionary Stability towards the Continuity of Life through Offspring or a social Construct due to Civilization? Can be actually shared by both? Can be also Part of another Subsystem? Many Properties do not have clear Ownership and this is where the Conflict of Opinions between Experts arise.

Remark 28.1.0.1. The most important and known Ability of Intelligence is the Consciousness.

I define **"Consciousness"** as:

Def. 28.1.0.3*:* **Consciousness De. Bewusstein, Das συνείδησις, ἡ:** is the Awareness of the internal State of the Mind

This Awareness is endowed with Introspection and mental Clarity.

The Definition of Consciousness is somewhat problematic since is of Interest to Philosophers as well as Neuroscientists and Psychologists resulting to conflicting Perceptions and even more conflicting Definitions. The Latin Etymology is derived from the Greek Etymology and describes a Prefix συν meaning "together" with the Word εἴδησις meaning "knowledge". I perceive this Meaning as the internal Dialogue that a Person performs when he thinks: we mostly use our MotherTongue or our Perception as when we were Kids guided by an Adult when we think and this is for me an Evidence that we consider our Mind as a different Person (the Soul?) which always hears us, and through its emotional and mental Response leads our Actions and Behaviors.

I define **"Mind"** as:

Def. 28.1.0.4*:* **Mind:** is called the intellectual Ability of a Person AKA Intellect.

The PsychologyDictionaries avoid to define this Term since is perceived very gen-

eral. In addition People are very complex Entities and they can't easily explain their Patterns of Actions, Activities and emotional Response. Typically the ancient Philosophies and Religions had to consider on the Latter a hidden Element of Influence called the "Soul" AKA "Psyche". It is *mostly* agreed by Psychologists, that the Mind acts on the PersonalityLevel while most Philosophies and Religions consider the Soul as the true Self.

With respect to Mind, Consciousness is the Controller of the **Automation** [3] and **Autonomy** [4] of the System that holds Intelligence. Consciousness is affected by Conscience; I define "Conscience" as:

Def. 28.1.0.7*:* **Conscience, De. Gewissen, Das, Lat. Conscientia, Gr. εὐσυνειδησία, ἡ, συνειδέναι, τὸ, σύνεσις, ἡ, εὐσέβεια, ἡ:** is a HumanTrait to exert ethical Judgment.

The ethical Judgment provides a FrameWork for the proper Behavior of an Individual within a social Context. The Term **"Proper Behavior"**, I interpret it as the Absence of Conflict within social Interaction [5] . This ethical Judgment is a Mix of mostly four Codes (i.e. Set of Rules), the genetic Affinities to influence social Behavior, the social Experience of the Individual, the MoralCode dictated by Religion and Tradition and the EthicsCode dictated by the CivilizationLevel of the Society where the Individual resides.

Most of HumanBehavior is constraint by a MoralCode (religious Persons) or a EthicsCode (Atheist) in order for the HumanSpecie to survive as Part of a civilized Society. Civilization is based on the View of social Solidarity and a limited but equal important Aspect is the binding Effect of Religion: Religion supplies the Code of Morals that serve as the initial Views of the Persons. Ethics supplies a less strict Code of Behavior.

Having paved the Ground with the Tears of Definitions, I define **"artificial Intelligence"** as:

Def. 28.1.0.8*:* **Artificial Intelligence:** is an Intelligence created by another Intelligence, the Originator, with a Process which is foreign to the ProductionMechanism of the Originator itself.

Within this Definition, I consider "artificial Intelligence" as any other Intelligence, whether Human or Animal. However, the Definition focus on the ProductionMechanism of the Intelligence and terms it as "foreign"; assuming that the Originator recreates Intelligence by Birth and using the same Process as that which brought him to Life, then a Process which is completely different from his own, will not create similar Intelligence, but will create artificially an Intelligence. As a Test of the Definition, I will consider that in the near Future, a Scientist succeed to create a working artificial Womb for a Fetus; is the Intelligence born an artificial Intelligence? No, its not! While the ectogenetic (outside of Uterus) fetal Development is something not found in natural Processes of Mammals (as far I know, I am not speaking about Platypus!), the Processes involved to create a Mammal are all natural and based on the Composition of the Parents. A foreign ProductionMechanism will use completely different Technologies and Materials, in our Time probably Electronics, to create a new Intelligence, consequently there will be no Similarity between the Species. In the Creation of new cellular LifeForms an artificial Intelligence? This

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[3] *Def.* 28.1.0.5*:* **Automation (SystemsEngineering):** is the Capacity to perform Tasks in a standardized Manner so that the least Effort is done by the System while the Tasks are fully serviced.

[4] *Def.* 28.1.0.6*:* **Autonomy (SystemsEngineering):** is the Independence of a System to any other System as a Mean of Survivability and Self-development.

[5] I know that very well. I have a Certification on ConflictManagement somewhere; I was young, I didn't know.

will depend on the Metrics employed to measure the Distance between our Species and the new Species with a Set of common Properties; I have no easy Answer here. *I am just a Plumber.*

28.2 SoftwareAgents

Having a Definition on Artificial Intelligence, its Time to regard the close Relatives to Abilities of Artificial Intelligence. The closest Relative is an "artificial Intelligent"-Agent. This is a ComputerProgram that uses PatternRecognition to determine an InformationExchange. To define such an Agent I must to define some other Terms.

As I defined elsewhere in this Book, a Pattern is a temporal and/or spatial Description that follows specific Rules of Deployment. A Pattern can be identified by defining the deployed Property that the Description apply. PatternRecognition is defined as:

Def. 28.2.0.1*:* **PatternRecognition:** is a System of Identification of Patterns based on searching the deployed Properties that are Part of a Pattern.

"PatternRecognition"-Systems have a long History in Computing as they were devised for optical CharacterRecognition (OCR), i.e. scanning printed Text and converting it to "Computer stored"-Text. "PatternRecognition"-Systems use the SoftwareModel of the Perceptron (among others) to train a ComputerProgram to TextCharacters and then to identify the TextCharacters electronically. The Perceptron is a SoftwareModel (as well as HardwareModel) of a Collection of NeuronCells as they are encountered to the HumanBrain. The Perceptron is a Model of an artificial neural Network. I define an artificial neural Network as:

Def. 28.2.0.2*:* **Artificial neural Network:** is a MessagingNetwork that employs DataInputs and Feedback so that the collected Data from the Network form a TrainingSet together with an Identifier that ideally will set the Network to a State where Data can be identified if they recur.

I will no go to the Details of such Technology, but an easy Text, was [Anderson et al], while a more professional Text is the Field is [Haykin]. These Networks are studied mainly by the Disciplines of SignalProcessing and SoftwareEngineering. What is more important in artificial neural Networks, is that they can be mapped and perform AutomationProcesses but unfortunately they do not provide, until now, an artificial Intelligence. Things changed though with the Advancement of the so called "intelligent Agent" (more Definitions Guys!).

An Agent is a Representative. By Definition:

Def. 28.2.0.3*:* **Agent:** is a representative Person for another Person.

A SoftwareAgent is a small ComputerProgram that assists the User regarding other SoftwarePrograms. By Definition:

Def. 28.2.0.4*:* **SoftwareAgent:** is a SoftwareApplication that assists a SoftwareUser by providing Assistance to a SoftwareTasks.

An Example of SoftwareAgent is Panes are the ChatBots where the Client can ask for a detailed Question and the ChatBot will forward the Client to a Product [6]

28.3 Intelligent and IntelligenceAgents

While SoftwareAgents were initially termed "intelligent", there was no so much Difference with "normal" Software: the SoftwareAgents were using simple TextProcessing and small DataBases to assist their Task. The Things changed with the Use of artificial neural Networks,

[6] Here your PornMovie Sir. We hope to see you less frequent ☺.

which gave to the SoftwareAgents the Capacity to determine Patterns for the Queries of Clients. While this Technology stagnated for a while, the last 15 Years there was significant Developments in the Area of computational Linguistics, MachineLearning and semantic Learning. An important Development that publicly occurred was the Release of the so called "large LanguageModels", LLM's which are artificial neural Networks trained into very large DataSets of "textual and understandable by Humans"-Data. In these Models, a Query in natural Language can be used to release Answers containing Data, where the Data themselves are hidden inside the large DataSets. While the textual Response of an LLM resembles a living Being, the LLM is not an Intelligence! In fact, the current Effort of ComputerScientists is to embed LLMs into SoftwareAgents so that the SoftwareAgents will become real *IntelligenceAgents*; notice that I wrote IntelligenceAgent and not intelligent Agent. Applications of these IntelligenceAgents will be in critical Applications; the main Problem here, is that the Technologies for these KeyElements are not spontaneously coming! These Technologies diffuse the technological Landscape very slowly. E.g. Optical CharacterRecognition, OCR, exists since the 60s, however for OfficeApplications since the Middle of 80s [7] .

The current Technologies used for SoftwareAgents are LearningTechnologies and "real time"-Processing, i.e. large data Processing for Applications that dynamically feed Data. Consequently I define an intelligent Agent as:

Def. 28.3.0.1*:* **Intelligent Agent:** is a SoftwareAgent that employs LearningTechnologies and consequently is more closely to the Communication with the User.

I define an IntelligenceAgent as:

Def. 28.3.0.2*:* **IntelligenceAgent:** is a SoftwareAgent that employs a large LanguageModel together with "real Time"-Stimuli.

Having defined these Agents, my Belief is that eventually most of the Software as we know it will be replaced with intelligent as well as IntelligenceAgents, including for the Subject of Computing itself the SoftwareApplications and OperatingSystem. These Agents will automatize most of the current Services done by Humans, leading gradually to a Reduction of Costs of Services as well as a Reduction to the Salary of Workers.

28.4 Future Directions for old Problems

Having spoken about he "Agents", is now Time to return to the Subject of artificial Intelligence.

Until now, the KeyTechnologies were SoftwareApplications running on digital ComputingHardware by Use of Electricity. Due to SpeedRequirements as well as ProcessingRequirements, the Hardware now shifts to optical Technologies but this Shift is very slow! Exists always the Idea of new ComputerArchitectures that use "analogue Electronics based" neural Networks but these Ideas are rather a wishful Thinking than a plausible Outcome due to physical Constraints that I am to depressive to mention. At least the feed Families of Engineers.

The current TechnologyShift for Hardware are the so called "QuantumComputers", which I haven't Idea or Time to understand how really work. So far I know, see [Maizner et al](Chapter 5, Section: 5.5 on Quantum Information, Quantum Com-

[7] We really don't know the Extend that these Technologies have diffused to our World, but obviously the People who know People, i.e. Politicians, have allowed "PatternRecognition"-Technologies and semantic Technologies into the KeySector of Banking, well before us, the Plebeians.

puters, and Quantum Complexity) these Computers employ the Ability of Particles to be in different States at the same Time and essentially compute Problems from different Perspectives [8] . Its precisely this Ability of Computation that is targeted to be the Processor of an artificial Intelligence. However, *with great Power comes great Irresponsibility* (As the Marvel™Deadpool™once said), and we have enough Problems to model a very dense artificial neural Network; we don't know how a QuantumComputer will retain the internal Settings while tackling very complex Queries.

The Idea that an artificial Intelligence can become an Enemy of Mankind, is very old, as well as the Idea of a Robot, from Talos in Ancient Greece until Metropolis of Fritz Lang. This Idea stems from the Concept that an Artificial Intelligence does not have Conscience and consequently will adhere to the Idea that the Creator (i.e. Human), is a less important than the Creation, (i.e. the artificial Intelligence). While this Idea has valid Foundations since an Artificial Intelligence is based on Logic and not Emotion, I will argue that what we consider as a positive social Response can be achieved by an Artificial Intelligence due to continuous Introspection and Adjustment to external Stimuli. Saying that, on the Side of Consumer-Products, it is more likely to see IntelligenceAgents which are more robust to malicious Excitation than an artificial Intelligence [9] .

However there is a more darker Area of artificial Intelligence: the current political Status Quo. The Corporations and Lobbies, that currently develop Projects based on artificial Intelligence, are very conscious of the Prospect that they can loose their Power; It is very easy to make a Demonstration outside Victoria Railway Station in London, but is extremely difficult to make a Demonstration at the British StockExchange; a StockExchange is more important for the Power that it holds than for the Money it controls, and consequently is religiously protected by the Authorities. Having an artificial Intelligence available will endanger the current PowerState of the financial, religious and political Status Quo and this is the Reason of the current GateKeeping from Authorities (i.e. Politicians) and Corporations. An Example of this GateKeeping can be found in the currently available LLMs which are censored or at least provide partial Answers to KeyQuestions. Consequently under the current political Situation it will be unlikely to see an artificial Intelligence. Perhaps if the political Environment radically changes (Gallows pending!) then and only then it will be possible to see an artificial Intelligence. Instead is more likely to see IntelligenceAgents presented as artificial Intelligence and most probably under the Stress of the coming SinoAmerican War.

A more darker Idea is to embed SoftwareAgents and their Electronics to the HumanBody, what I call "embedded Intelligence". This is the Idea that the Transhumanists preach and as Idea will separate the Human from Nature. To understand this you need to understand the following Pattern: a Person becomes rich by loosing gradually most if not all the Aspects that make him a Human, with a Relation that the most HumanAspects you loose, the more rich you become; as such, if a Billionaire becomes half Machine, this only verifies that he already lost his Humanity. With Dark consequences for the People under him.

[8] We don't study these Blasphemies, we are Christians!☺

[9] i.e. imagine a SexRobot abused by a Human; if the Robot contains an IntelligenceAgent, then it will not produce an adversary Response to the Human, however if the Robot contains an artificial Intelligence, then the Robot will produce an adverse, and in my opinion fair Response, even ethical according to my Criteria, irrespective of any excessive Brutality it exercised to the Perpetrator.

28.4.1 Bibliography on artificial Intelligence

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Chapter 29

Personal Opinions on Magic, Paranormal and the Rest

Narrative

Magic, Paranormal, Secret Organizations and Conspiracy. This Chapter describes Subjects that do not belong to Science but in Religion, nonetheless affect our Society in subtle Ways that are too powerful to ignore. The mentioned Subjects are endowed with Misinformation, Prejudice, Fear and Secrecy, with the Latter the Source of Resistance to scientific Query. The Approach to their Examination by me, is purely academic and targets to remove the Beliefs that they were attached to these Subjects. Consequently, its my Purpose to provide Clarity on them, so that a Scientist can approach them without falling Victim of them. The Material provided draws from my personal Research as well as Experience, which I am proud, since it gave me a Perspective to understand the psychological, and not only, Processes that drive Society.

On the Subject of Magic and secretive Societies [1] this Chapter is intended to warn and inform the Scientists about them as well as their psychological and political Effects. These two Subjects are used by Swindlers to obtain Benefits from their Victims while their Victims continue to be under their Influence, even long ago their Separation.

I will not disclose any Resources on the core Issues of Magic and secretive Societies except some ethnological and psychological Resources, in order to avoid to pollute the Reader with **mental Garbage**. In addition my Purpose is to teach some Terms to the People so that they can be clear on their Beliefs and *by Inference* who controls these Beliefs.

On the Subjects of Conspiracy and genetic Selection I provide my Opinions as well as some Definitions. There is some Bibliography on all the Subjects here.

29.1 Magic

It is impossible to explain a Subject such as "Magic" without to place it in the Framework of scientific Study. Do we have a chaotic FrameWork of Beliefs made by Swindlers through the Centuries or a complete System of scientific Development on Beliefs? The Subject does not have a formal Development, nor the followers of the Subject have a proper, academic Education. To explain "Magic", I must to enclose "Magic" to the Subject of Paranormal and then expand it for Reasons that will become apparent.

The Paranormal is any Phenomenon that we cannot explain scientifically [2] .

[1] "Secretive", not "Secret"-Societies! A **secret Society** or Organization is not known to Persons outside the Area of Influence.

[2] While this book does not give a Definition on

Def. 29.1.0.1*:* **Paranormal (Noun and Adjective):** is any Event or Phenomenon that fails to be explained by the scientific Method.

The **Study of paranormal Phenomena** related to **religious Experience**, as well as the Study of Magic, fall under the Term **"Occult"**. Scientifically, the Study of Occult falls under the Investigation of **Ethnology** as well as **History of Religion**. Some aspects of the Occult, in particular paranormal Phenomena related to religious Experience, are also studied by a Mix of Sciences such as Psychology, Psychiatry and Physics. The **Practice of Occult** is not a scientific Subject (unless is studied under the ethnological Point of View) since involves blind Belief to the Supernatural and consequently this impedes the scientific Study.

Def. 29.1.0.2*:* **Occult (Noun and Adjective):** is the Study of Magic as well as the Study of paranormal Phenomena associated with religious Experience.

For Completeness I describe the Term "religious Experience":

Def. 29.1.0.3*:* **Religious Experience:** is any fundamental Experience asserted by a Believer of a Religion, and as such, determines the Life of the Believer.

E.g. A Person experience the Belief of Community according to the Christian Gospels and consequently this Experience compels the Person to act as a Christian to every social Interaction.

While Magic is associated with religious Believers which themselves claim to connect with invisible Forces, I will make here the Distinction that Magic is a Process that can create non causal Phenomena; Whether this is true or not, it does not matter since we must understand the Claim, not its Fallacy or Truth [3] ! By Definition:

Def. 29.1.0.4*:* **Magic:** is called any Process invoked by a Human, such as, it can create non causal physical Phenomena.

Needless to say, in Science there is no known Process besides of QuantumPhenomena that can cause non causal Phenomena; consequently Magic is not something that is recognized *on Consensus* by Science. However, most if not all Religions recognize Magic, since Religions recognize that non causal Phenomena are caused by the "**Holy**".

The **Holy** is a Concept found in most of Religions and concerns an Aspect of Reality that shields itself from the **Mundane**, i.e. the tangible Aspect of Reality, in a Sense that "Holy" is morally Superior regarding the Mundane. To understand the Distinction of both, I must to describe the Word "Reality".

Def. 29.1.0.5*:* **Reality:** is called the current State of Existence of the Universe, viewed from every Level that is widely accepted as Truth.

The Term "Reality" in the ViewPoint of a Scientist encompass all these Items that we recognize as true, whether they are Tangible, e.g. a Table, or intangible e.g. Love. Withing Reality, there are many Processes, Phenomena and Events that are hidden or even unknown. Typically unknown Items we categorize them to be Parts of our World by placing them on the Label "Not yet known". However the old Civilizations having a different ViewPoint, regarded that these unknown Items and Processes were Part of a World that controls our World with both Worlds representing Reality. The controlling Part of

Paranormal, this Book, [Tart et al], provides Examples of paranormal Phenomena and practical Applications under scientific Scrutiny. Yes, some Scientists actually study the Paranormal.

[3] A Definition must describe the Assertion that is claimed. There is a Reason of it: the Definition should precisely describe what the Proponent of the Definition asserts. Otherwise, the Definition is just an Observation from someone that does not understand or does not want to understand the Ideas behind it.

our Reality, is a World where the People do not have Access, while the controlled Part of our Reality is our tangible World. The Culmination of this ViewPoint came from Plato, a Philosopher and Student of Socrates, who took the Effort to formulate this Description. It was suggested by Plato [4] that **Ideas** are *perfect* Aspects of another World, and Ideas reflect and create the Reality of our World, the **Mundane**; consequently I suggest that Plato considers the "Holy" as "Idea".

Def. 29.1.0.6*:* **Holy:** is called the RealityAspect that is morally Superior to every other RealityAspect and is a Part of another Universe called "World of Ideas".

Remark 29.1.0.1. Consequently, while an Idea belongs to another World, its Effects transcend our World.

Def. 29.1.0.7*:* **Mundane:** is called the RealityAspect that is morally inferior to every other RealityAspect and is Part of our Universe called "mundane World".

According to Proponents of Magic, Magic controls the Communication and Action from the Holy to the Mundane, having as Conduit a HumanPermormer called "Magician". Typically Magic is taught by people called **"Magicians"** (singular: Magus, plural: Magii AKA Magicians) that hold their own Schools which are non scientific Institutions (also known as "**Schools of Mysteries**") with very few Members, called "Disciples" or "Students". The Magicians assert that they hold a **revealed Knowledge** [5] and an Capability to control (i.e. Power) the People and the mundane World. They assert that this Capability comes from their Connection to the Holy. Since this Connection provides Power, then an important Aspect of teaching and practicing is the Use of Secrecy in order to avoid any Use of Magic by non authorized Persons, since the Use of Power is Subject of moral Restrictions that are either implied or explicitly stated in the Curriculum of the School of Mysteries.

Since the **Subject of Belief** is shared by both Religion and Magic, there is always a Conflict between Religion and Magic concerning which Institution (Church or School of Mystery) will hold the Power over the Citizens that want to believe in a moral Authority, whether this Authority be Gods or Spirits.

Persons outside the Schools of Mysteries have certain Beliefs about Magic which are based on either Superstition, Religion, MediaInfluence or personal Expectation. These Beliefs hold as Hostage any Person interested in Magic. Since, by default, Schools of Mystery propagate the Ownership of Power, the People are curious about this Power, and they can quickly develop new Beliefs about it in a Sense that this Power has Control over them: the Secrecy that shrouds Magic, works to enforce Expectations.

29.2 Soul and Spirit

Behind the natural Curiosity of the People to investigate the unknown, comes a very important Aspect, the one of Spirit. According to most of cultural Beliefs, a Human besides his Body has a Soul AKA Spirit. A Soul is considered as something that resides in a living Body and is intelligent as well controls the Personality, it is immortal, indestructible and sometimes transferable to another living Body upon

[4] The Theory of Ideas was introduced by Plato in his Book "The Republic". A good Explanation of this Theory, can be found in [Grube], which I strongly suggest as first Reading; classical ancient Literature has linguistic Aspects that are very foreign to the Perception of the modern Reader and somewhat can perplex the modern Reader.

[5] A Difference of a Scientist from a Magician is that *a Scientist discovers Knowledge, while Knowledge is revealed to the Magician.* While this View is very Different, the Scientist at least on Paper, tries hard to deduce the Laws of the Universe, while the Magician *claims* that he has Access to these Laws.

Death of the original Body (Belief in Reincarnation).

Def. 29.2.0.1*:* **Soul AKA Spirit:** is a non physical Body that resides in a living Body, it controls the Personality, is immortal, indestructible and in some Traditions transferable to another living Body upon Death of the original Body.

Remark 29.2.0.1. It is believed by most Religions, that the Soul is the only Part of a Human, that is directly connected to the Holy.

Since the People attach these Properties of the Soul in the Holy, then they assume that the Influence of Magic affects also their Soul. Another Assumption is that the modern Way of Living affects negatively the Wellbeing of Persons, so that there is a Demand to rectify the Connection to the Holy. The Connection of the People with the Holy is called "Spirituality" and is different for every Culture and religious Belief. It is defined as:

Def. 29.2.0.2*:* **Spirituality:** is the Connection of the People with the Holy.

The Term "Spirit", besides its Synonymity with the Soul also concerns nontangible intelligent Beings called Spirits, that are Manifestations of the Holy in this World and they don't have a physical Body. The "Spirits" can be according to most Cultures, malevolent or benevolent.

Def. 29.2.0.3*:* **Spirit (nontangible intelligent Being):** is a Being that is Part of the holy World and manifests itself into the mundane World in very subtle Ways.

29.3 Anomaly and Supernatural

In Paranormal, the Terms "Anomaly" and "Supernatural" are frequently encountered.

"Anomaly" is called any Item that does not agree to

Def. 29.3.0.1*:* **Anomaly:** is called any Irregularity that appears to diverge from the scientific Observation or Law.

"Supernatural" refers to the Concept that beyond Nature, exists another Level of Existence, superimposed to Nature (super AKA over), that holds Control of Reality. This is not a practical Term in the scientific Endeavor, so I deprecate it.

Def. 29.3.0.2*:* **Supernatural:** is a Layer of Reality inaccessible by the current scientific Practice.

Remark 29.3.0.1. While Supernatural discriminates itself from Reality, it is not Synonymous with the Holy.

Studies in Anomalies can be found in Catalogs provided by William R. Corlis. Corlis compiled Catalogs of Anomalies concerning various Subjects, such as Biology, Geology, Archaeology among others. His Effort was called "The Sourcebook Project" and published the following Titles, which by my Experience are very difficult to get an actual Copy. From this Book, I ask University Institutions to collect the published Material and create Copies for Universities so that these Anomalies eventually will be resolved from Science. Kudos and RIP W.R. Corlis for the great Material you compiled!

- Anomalies in Geology
- Carolina Bays, Mima Mounds, Submarine Canyons
- Stars, Galaxies, Cosmos
- The Sun and Solar System Debris
- The Moon and the Planets
- Lightning, Auroras, Nocturnal Lights
- Tornados, Dark Days, Anomalous Precipitation

- Earthquakes, Tides, Unidentified Sounds
- Rare Halos, Mirages, Anomalous Rainbows
- The Unfathomed Mind: A Handbook of Unusual Mental Phenomena
- Incredible Life: A Handbook of Biological Mysteries
- Unknown Earth: A Handbook of Geological Enigmas
- Mysterious Universe: A Handbook of Astronomical Anomalies
- Ancient Man: A Handbook of Puzzling Artifacts
- Handbook of Unusual Natural Phenomena
- Strange Phenomena, vols. G1 and G2
- Strange Artifacts, vols. Ml and M2
- Strange Universe, vol. A1 and A2
- Strange Planet, vols. El and E2
- Strange Life, vol. B1
- Strange Minds, vol. P1

29.4 Initiation and Mysteries

Colloquially an Initiation is an Introduction to something. Concerning Schools of Mysteries an Initiation is the Introduction to the School and the Passage to Stages of Knowledge within the Curriculum of MagicTeaching.

Def. 29.4.0.1*:* **Initiation:** is called any authorized Introduction to the School of Mysteries as well as any authorized Examination of the Teachings of the School of Mysteries.

Remark 29.4.0.1. Any Initiation is followed by an Oath of Secrecy concerning the Initiation and the Knowledge attained by it.

Typically an Initiation is followed by a **Ritual**, which is a metaphorical Operation, i.e. an Act, that is asserted to invoke the Holy to manifest its Existence to the Mundane. The Term "metaphorical" concerns in this Context the Creation of a static and dynamic Environment which demonstrates all the Properties of the Holy and consequently invokes the Holy to manifest itself to this World.

E.g. to manifest a Spirit you need to add to the Place of Manifestation Symbols, Items, Colors, Smells, Sounds and Configurations of them in a Manner accepted by the Teaching.

Def. 29.4.0.2*:* **Ritual:** is an Act that metaphorically invokes the Holy to manifest its Existence to the Mundane.

"Mystery" is an Aspect of Reality that cannot be investigated or explained. In Magic, a "Mystery" is a Term that comes back to us from Antiquity, in particular from ancient Greece and refers to Rituals of the Greek Religion; as such, a Mystery has the Purpose to manifest the Holy for a required Benefit.

Def. 29.4.0.3*:* **Mystery:** is called any Ritual that has the Purpose to manifest the Holy for the Benefit of the the Person involved in the Ritual.

Remark 29.4.0.2. Typically the Magus acts as the Conduit for the Manifestation of the Holy to the Mundane.

E.g. The religious Marriage is a Mystery that binds the main Participants to a Connection that is recognized by the Holy and the Witnesses.

E.g. In Christianity (Catholicism) the Mysteries are called "Sacraments" and are Baptism (Naming the Person and his Membership to The Church), Matrimony (Marriage), Confirmation (the Ac-

ceptance to the Church), The Holy Eucharist (Thanks to the Appearance of Jesus Christ as in the Symbols of Bread and Wine), Penance (Confession of the Guilt due to Sin), Anointing of the Sick (placing "Holy Water" on the sick Persons) and Holy Order (Making a Priest). A Discussion about these, occurs in [Broderick].

Passages from one Level to another Level within a School of Mysteries are also considered Initiations but may have different Names. However, after any Initiation the Disciple receives a Grade which certifies him. A Passage is allowed only if the Disciple provides Evidence of Understanding of the Knowledge he encountered or received; such Knowledge is based on Symbols that he studied and then demonstrated their Use. The first Initiation, which I will call "Entry" does not need any Certification, besides the Interrogation of the Candidate by the Leaders of the Schools about his Intentions. If these Intentions are considered and demonstrated by his public Life as appropriate then the Candidate will participate into a Ceremony or Ritual to establish his Entry. After this Entry his Indoctrination takes Place.

The Word "Ceremony" appears very frequent to the Literature about Magic. I define it as:

Def. 29.4.0.4*:* **Ceremony:** is an Act that officially and under Coordination denotes an important social, academic, military or religious Event.

While a Ritual connects the Holy with the Mundane, the Ceremony simple denotes an Event. Consequently a Ceremony does not convey any Manifestation of the Holy to the Mundane and as such is not a magical Event.

E.g. The Ceremony for the Students to get their Degrees.

The Terms "Doctrine" and "Dogma" appear very Frequently in the Schools of Mystery and concern the Operations, Structure and Principles that permeate these Schools.

A Doctrine is associated with the Beliefs of how the School is organized and operates. It is defined as:

Def. 29.4.0.5*:* **Doctrine:** is a BeliefSystem of an Organization, which defines the Operations and Structure that the Organization adheres.

A Dogma concerns the Principles that emanate from a Belief.

E.g. In Christianity, the caring about the fellow Person is a Belief that creates Principles, such as the one of sharing Resources with the fellow Person with the Prospect that this Help will make the Coexistence peaceful.

A Dogma is defined as:

Def. 29.4.0.6*:* **Dogma:** is the fundamental Principles within the Belief of an Organization.

Finally, a Note about Research: the Schools of Mysteries have also their ResearchLiterature also called "esoteric Literature", i.e. "inner Literature". It consists of Books and Procedures. The People that study scientifically the esoteric Literature are called "Scholars" if they belong to a School of Mystery, or "Scientists", if they belong to an academic Institution that studies the School of Mystery. Some "Well established"-Religions avoid today the Term "Mystery" to their Institution so that they attach a Sort of Seriousness to their Endeavor. Whether a Clown has the Label "Clown" or "Professional Entertainer on demonstrating Absurdity", this does not matter on my Opinion: he is still a Clown ☺.

29.5 The three Elements of High Attainment

Schools of Mysteries promise to their Members the Capability to Control the Mundane due to Connection with the

Holy. From this Promise, arouse Expectations from their Members about the Benefits that these Schools provide. These Expectations deal with three Aspects of Life that I call **the three Elements of High Attainment**. While the first is plausible to be attained by a Person, two of the Elements need the help of the Holy to be realized, since they are, practically speaking, unattainable.

The three Elements of High Attainment are absolute Power (via political Lobbying and electronic Surveillance), absolute Knowledge and Immortality. [6] .

Esoteric Literature provides countless Examples of the three Elements of High Attainment, and is used as a Bait to attract useful Idiots. However this is rather a Shift to our cultural Inheritance, I will now explain. These three Elements were what decadent Persons considered as the only Items that are worth a Living, while **The West** considered that the Examination of Self is only worth a Living (See [Plato] on Apologia, where Socrates said "An unexamined Life is not worth a Living" in the Context of Selfdevelopment). I suspect the decadent View arouse due to cultural and political upheaval that found no political Resistance to bring any fundamental societal Change [7] .

[6] These Elements are what currently the Transhumanists want to Attain: Political Power, "Computer assisted"-Knowledge (Artificially Generated Intelligence anyone?) and genetically assisted Immortality.

[7] **Political Decadence** is the Condition of a Country where the Administration and Institutions do not cooperate to make possible the Mechanism of Cooperation for the common Good (i.e. *there is Society but not Community*). In my Opinion, when this happens, then internal Conflict arises due to political Vacuum. When no internal Conflict arises, it means that the Citizens do not have any Resistance to what destroys them; as such, they will be corrupted by materialistic Views and not ideological ones. By my Opinion this is the current State of Affairs.

29.6 Secretive Societies

Magic is a religious Practice that due to its alleged PowerAspect, is shielded from the Outsiders who are considered unprepared for Knowledge and have the Tendency to abuse Power [8] .

The PowerAspect of Magic was frequently used by Individuals such as religious and sectarian Leaders to assert Control to their Followers. Schools of Mysteries were frequently banned from the Public, since their alleged Power was considered a Danger for the public Authorities precisely due to the political Implications that could be caused (Conflict of Interests between Authorities and Schools of Mystery).

It was the Repression of Christianity during its historical Course to ban Schools of Mysteries. This Repression forced the Schools of Mysteries to hide from the public Eye. The Hiding started immediately when Christianity was recognized as Religion; we don't know what happened to the Schools of Mysteries after that; Just for Reference, the Athenian Academy reestablished itself to Persia, the original Empire where Iran is today located.

Renaissance came and political Organizations copied the administrative Structure and Symbolism of Schools of Mysteries. This was a careful Operation to harvest new Members and use them for political and financial Power. The Bait that was used for the Members was more or less the three Elements of High Attainment [9] . The Doctrine that was implemented was

[8] Just remember that you will not arm a "third World"-Country with nuclear Weapons for a Reason, or give a CreditCard to a Kid. Without ethical Background, Power corrupts and brings Misery.

[9] In particular Alchemy, the *Philosopher's Stone* was the ultimate Goal of the Alchemist, that will give him Immortality, Knowledge and Gold. In Magic, the Secret of Secrets was the Center of the magical Work that will give to the Magician the three Aspects of High Attainment. I would have being more pleased for not paying Taxes for 100 Years, so at least for my Kids to drink a Glass of Wine to my Memory.

an Abrahamic as well as pseudopolytheistic Set of Ideas due to the Familiarity that both Doctrines offer to the European Population.

These political Organizations are mostly called "secret Societies", but they are not secret: we know about them a Hell a lot. The Term that should be used is "secretive Societies". They perform Ceremonies which appear to have a deep philosophical Background; this is of course pure Rubbish, since their Doctrine has been found in Libraries and have been analyzed and found to be sectarian. *At the best.*

It is the Seeking of particularly young Scientists as Members for such Organizations that here is a Matter of Concern. By applying psychological Pressure and Expectation, these Organizations recruit intelligent but obedient HumanResources needed to provide Money, Support and ultimately their Life for Purposes that provide hidden political Power (i.e. more or less a hidden Lobby). The Method that they employ is Secrecy and under the umbrella of Secrecy they trap people who themselves are incapable to raise real power. By Definition:

Def. 29.6.0.1*:* **Secretive Society:** is a political Organization that has the Purpose to raise political Power and performs Ceremonies to provide moral and emotional Status to itself and its Members.

Serious People do not get involved with secretive Societies since these Organizations perform Lobbying, are not transparent to public Query and work on their own Rules outside the Public, consequently and very often the public Good is in direct Conflict with the Purposes of these Organizations.

29.7 A Framework for Selfdevelopment

It is very unlikely that you will meet a pure Scientist in your Life, since most of People have a Mix of the the three WorldViews, i.e. Religion, Art and Science. In addition, most of the People have strong the Aspect of Religion and less the Aspect of Science. Because Religion is based on Belief and such a Belief is promised by Hope, the People are very unlikely to change their Opinion about their BeliefSystem even if they change Religion; The BeliefSystem of normal People is actually quite different of what their Religion has to offer, since most of the People cultivate Expectations about what Religion is, Expectations that are conflicting with Religion.

E.g. In my Experience, most of the European Pagans that I met, were People that they believe in Gods, but the Philosophy of their Belief it is Christian to its Core! They might have changed Religion, but still remain Christians.

My View concerning Religion, is for a Person to remain to his Religion if that Religion helps him to become better. Spirituality exists in most of Religions and each Religion provides a Scripture where a Person can find Details about the Connection to the Holy.

If the Person wants to have a different Selfdevelopment, then I will advice him to stay away from secretive Organizations and modern Schools of Mysteries. For me, original Schools of Mysteries have died the last 1700 years while secretive Organizations are concerned only to abuse you; if you want Power, you have to create it on your own, since only with Selfdevelopment as well as personal Independence you can attain a decent Control over Reality.

Speaking of which, I will have to introduce a Term that made a Comeback about the Year 2000, and this is "Tradition". A **Tradition** is a Container of mental Beliefs concerning Spirituality. It appeared with [Guennon] and vastly popularized with [Evola] [10]

[10] Evola made the Research concerning secretive Societies on the Behalf of the Ahnenerbe in Vienna, Osterreich. Its because of Evola we have currently open Archives of most of the secretive Organizations. Similar to the "open Source"-

Def. 29.7.0.1*:* **Tradition:** is a Container of mental Beliefs concerning Spirituality.

Remark 29.7.0.1. Tradition is influenced by cultural, societal, religious, historical and genetic Aspects of the HumanCivilization.

The so called "Western Tradition" (i.e. European Tradition), was a ResearchSubject that **Karl Jung**, see [Jung, Aion: Phenomenology of the Self] and [Jacobi] as well as **Joseph Campbell**, see [Campbell] studied and concerns the **Initiation as a Tool for Selfdevelopment**.

According to Jung, since psychological Problems of a Patient arise from the Discord between the Personality and the hidden Aspect of Personality (called "Shadow"), then a Revelation and Acceptance of the Shadow by a conscious Mind, can relieve the Personality from the psychological Problem is facing due to its emotional Conflicts.

Historical Research on Myths by Joseph Campbell, described a similar Pattern that occurred in Myths, something that he formulated as a single Myth, called "Monomyth", see [Campbell]. Campbell asserted that Freedom of the Individual comes through Monomyth, when the Individual takes the Call to the Adventure and steps on his heroic Path.

Jung asserted that the Schools of Mysteries in the Western Tradition had as Purpose to solve these Discords through Initiations and Passages, in a Sense that an Initiation can provide a Confrontation of the Personality with the "Shadow" in a controlled Way, so that the Patient can attain his Liberation from his psychological Problem. Such a Task is coordinated by a Teacher (*a Master*), that has intimate Information about the Student and can guide the Student to the Task of ConflictResolution.

Software, open Organizations can be scrutinized for Malevolence. Secretive Organizations do not.

E.g. An Initiation for overcoming Cowardness (this is my Opinion, surely there are other Opinions): The Hero "Luke Skywalker" [11] , in the MotionPicture of *Star Wars: The Empire strikes back*, is asked by Master "Yoda" to go to a dark Place. Luke enters a dark Cave alone and confronts the Fear of a very dangerous Person, which impersonates the most dangerous Villain of the Story, "Darth Vader". Luke decapitates (nice!) Darth Vader and the Face of Luke appears to be under the Mask of Darth Vader. Mapping this to the Explanation of Carl Jung and Joseph Campbell, Luke entered the Abyss of his Mind, found the Shadow, killed a Part of his Personality that the Shadow represents, that is, his Cowardness and attained the Courage to be able to fight alone.

The psychological Model of ConflictResolution that Jung proposed and Campbell verified, is a Subject of great Debate. According to Psychiatry there are many Methods to heal a Person, and the mental Therapist has a Variety of Tools to access the mental World of the Patient, some methods even through Medication.

Many Scientists as well as Individuals proposed an alternative Systems of Selfdevelopment based on Jung, notably Dr. Krippner and Dr. Feinstein [Feinstein et al] as well as Mrs. Carol Pearson [Pearson]. These created a Framework for psychological ConflictResolution which can be roughly considered to what Campbell denoted as "**Heroic Path**". Though I endorse the Model, I have found that unconditional Confrontation with Reality is an appropriate Step that can help the Individual to heal without to resolve to SelfdevelopmentMethods or deep Analysis [12] . Medications can also help, but these can

[11] Luke i.e. Greek for "Lightful", i.e. Lightful Skywalker, I can imagine personally a Comet as a Symbol of good Hope. Make a Wish now!

[12] As once I was hit hard from a martial Arts Teacher, I learned that Politeness is nice, sometimes mere Brutality is better: this goes to the Politeness of Psychanalysis and the Reality of Life. And yes, I am useless in martial Arts but at least I tried.

only be carefully deployed and administered by specialized medical Personnel.

Speaking of the "Heroic Path", most of Religions have more or less their Methods and Procedures for the psychological ConflictResolution. However their Methods and Procedures do not adhere to Science and are very trivial to their Interpretations and Support with respect to scientific PatientSupport. Nonetheless are still responsible for the mental Healing of Millions of People.

29.8 The Reality of Conspiracy

The "Covid"-Pandemic brought some Changes in the public Life regarding the Rights and Duties of the Individual in Face of a Pandemic. The Society as a Whole was fractured in the Question or Requirement of Vaccination against a Disease that had around 0.3 MortalityRate [13] !

They were many Unknowns to the Course of the Disease. The one for Sure, that the Virus originated in China [14] . This initially was denied by the Authorities worldwide, but eventually it was true. It was also true that the USA Health Organizations made Research on "Gain of Function" in "Corona"-Virus, something that initially was denied as ConspiracyTheory. "Conspiracy" means one or more Persons to engage to an Activity that will make something evil.

E.g. Tim and Joe conspired to remove Mary from her Job by lying to her Boss.

I define Conspiracy as:

Def. 29.8.0.1*:* **Conspiracy:** is an Engagement of a Person or Group of Persons in a secret Activity for a malevolent Purpose.

ConspiracyTheory is a Label attached to the Subject that some People consider that some Events or Situations are Conspiracies made from People in Power. During the "Covid"-Pandemic, the People that denied to get the Vaccination, were termed as "ConspiracyTheorists". On their Side most of the People that didn't want to get vaccinated asserted that Corporations (Pharmaceutical Corporations) were behind the Pandemic and these Corporations had as Purpose to vaccinate the Population for Reasons of Control. An Argument was placed against these Corporations, on the Base that that their Contracts with the local Authorities, were protected at least 80 Years from legal Action from the Public, in Case of Injury from the Vaccination. Another Argument was that the Vaccine was not properly tested, despite the Efforts of the Authorities and Corporations to assert that the Vaccine was "safe".

Currently the MortalityRate of dying young Persons is very high, but the Authorities do not want to place to them the Information concerning their Vaccination: did the young People dying have their "Covid"-Vaccine? This is the Question to be answered; If they were vaccinated and dying then the Vaccination did injure them.

Speaking of which, the Authorities were alleged for Corruption by the ConspiracyTheorists. Corruption is the Abuse of Power by someone who is in Position of Power.

Def. 29.8.0.2*:* **Corruption:** is the Abuse of Power by an Individual (or an Organization) who is placed in an uncontrolled Position of Power, due to his Malevolence.

It is well known that Corporations work "Hand in Hand" with Governments and political Parties. To deny that there is no Influence of Corporations to political Parties that spend Billions on political Campaigns is something that only Fools deny. However, there were no clear Evidence for such a Case during the Pandemic: except of continuous Defense on the Vaccina-

[13] https://www.worldometers.info/coronavirus/coronavirus-death-rate/

[14] https://pmc.ncbi.nlm.nih.gov/articles/PMC9874793/

tion overwhelmingly from the MassMedia which of course belong to Corporations.

Corruption and Conspiracy go together only when there is no Control of the Checks and Balances in a Society. A Scientist should be aware of both and in any Case sacrifice his Position by defending the Truth.

The great Thing that the "Covid"-Pandemic created is the Distrust to Authorities. Unfortunately this Distrust was made possible on Bodies. Dead Bodies.

29.9 Genetic Selection

Recently with the Advancement of the Discipline of Genetics, there is the winning Race to heal Diseases and Conditions that the current Medicine leaves untreated. The Purpose of this Section is to place my Opinion, together with an Understanding of the Terms and their Impact.

Def. 29.9.0.1*:* **Genetics:** is the Study of Genes and their impact in a living Organism.

While Genetics is concerned about Genes and their Impact, a particular Aspect of Genetics currently focuses on Heredity and has two Focii, the Healing of hereditary Diseases and the Enhancement of the Person through genetic Editing. Heredity is the Transfer of Traits to a Kid by his Parents. I define it as:

Def. 29.9.0.2*:* **Heredity (Genetics):** is the Propagation of biological Traits from a Parent to an Offspring.

Heredity passes Traits as well as Disorders. Traits can be blond Hair and noble PersonalityCharacter, Disorders can be "Sickle Cell"-Anaimia and some Forms of Cancers. While the Healing of the Persons is something that a Scientist as well as Society **must** to strive to offer to a Patient, its the current Issue of additional Traits that raise Questions.

Traits seem to appear as a Response of an Organism to new Challenges, and such a Response occurs, according to the current Data, gradually. The Mechanism for this Response is called "natural Selection" and I define it as:

Def. 29.9.0.3*:* **Natural Selection:** is a very complex Mechanism that offers Adaptation to a living Organism so that the living Organism can confront new Challenges to its Environment.

The Appearance of Civilization causes significant Changes to the HumanPopulation due to Change of Environment, the most common Change was the Colonization of every natural Habitat on the Planet, including Locations that are very hostile to the Humans. Changes of Diets appeared as well as Changes in the racial Profile of the Humans. Due to the increasing Disease as well as Criminality that was observed in HumanPopulations, the Suggestion was that the HumanPopulation needed a Set of Tools to combat these new "Traits". *The Discipline of Eugenics was born and is live and kicking.*

Def. 29.9.0.4*:* **Eugenics:** is a Set of Methods, Processes and Procedures that affect the genetic Quality of a Species.

Eugenics asserts that Diseases as well as Wellbeing, come from the Degeneration of the HumanSpecie. As such it asserts a Set of Methods, including Death, to remove the individuals which as Part of the Specie can contribute their Genes to the HumanSpecie. Because Eugenics was strongly supported by the National Socialists, it is considered a Pseudoscience by the mainstream Media, though mainstream Science *never* abandon it. It just renamed it. The informal Term is "genetic Selection". I define "genetic Selection" as:

Def. 29.9.0.5*:* **Genetic Selection:** is a Set of Methods, Processes and Procedures that ensure the genetic Quality of an individual living Organism as well as the

Transfer of new Traits to the living Organism.
[15]

Life is rarely Black or White and there are many Opinions of what are the Methods of Eugenics and what are the Methods of Genetic Selection. Does removing a Disease constitute a removal of a future Trait that actually is beneficial to the Species? Does the Removal of an aggressive Person is beneficial to a Society while there is no Policing to ensure that the Society works without Problem? Was the aggressive Person the Problem or the Authorities that do no like Policing so that they can cover their Dirt?

Currently the Genetic Selection is used illegally in Asia to remove the Probability of the Offspring to be a Girl [16] , while in Europe and USA the genetic Selection is used legally via pre natal Screening to remove Embryos with Down's Syndrome [17] . To remove a mentally disabled Embryo is perhaps, **Perhaps!**, morally approved, but what about a perfectly made Girl? See Abortions of female Fetuses in Asia [18] .

The Problems that concern me about genetic Selection is the artificial TraitSelection. Artificial TraitSelection by GeneEditing is currently researched for Applications on Offspring. GeneEditing is a Set of Techniques that can change Traits of the Offspring. The circulated Ideas of such Techniques is to add foreign Traits to the Offspring, ranging from high athletic Performance and high Intellect to Eye- and HairColor. While such Traits seems desirable, only by viewing a living Being as a Set of optimum Traits, we can understand that adding or changing Traits will disturb the Equilibrium that the living System of the Being created by Optimization of the existing Traits. In other Words, the Traits that Nature gave to a Person are optimized and cannot be disturbed. In addition, every Person in the World has a Purpose and a Function that cannot be ignored, nor they can be adjusted to the wishful Thinking of People paying for Distinction.

Another Concern is the one of Eugenics. Eugenics is a Spectrum of Methods from the most Hardcore to the most Softcore. An acknowledged Part in both Eugenics and orthodox Science is the Heredity of mental Disorders. Since I learned early to judge the Criminal as well as to forgive the Man that regrets his Past, I know that the criminal Behavior falls broadly to two Categories of social Integration: People who regret their Actions (they integrate to the Community) and Criminals who don't regret their Action (they don't integrate to the Community). For People who regret their Actions, the System, has a Set of Rules that are available and more or less work to the Reintegration of the former Criminal to the Society. *I know, I have seen it myself.* That the Society allows repeated Criminals of large criminal Action [19] as well as Criminals of *heavy Crimes* [20] to live or even to be released to the Public, this is above my Comprehension, since is very legitimate the capital Punishment in these Cases. Consequently in the current Republican System [21] , removing repeated Criminals of large criminal Ac-

[15] My Definition of genetic Selection implies that the genetic Selection does not affect the Species but offers a Customization of Functions of the living Organism.

[16] Here I will not mention the State of mentally disabled Offspring in the Third World, as a Reader make your Research.

[17] A Syndrome is a Set of Disorders. Just like you ☺.

[18] Here I don't speak of Abortions which I don't like but I accept as either a personal Decision of an Idiot of not buying a Condom or a Victim of Rape who on this Scenario, the Abortion is perfectly understandable.

[19] E.g. repeated Murder, repeated Robbery.

[20] E.g. Cannibalism, large Mutilation, Rape, Rape followed by the Murder of the Victim, Mass-Murder, financial Crime of large Proportions, Steeling from disadvantaged Members of the Society (Old Persons or Persons with Disability), Misinformation leading to social Upheaval or War, among other heavy Crimes.

[21] Democracy provides Legislation based on the Majority without Consideration of the Minorities. The Republic provides Legislation based on the Majority but with Consideration of the Minorities; this is why most of the "First World"-Nations are Republics, not Democracies.

tion or Criminals of heavy Crimes is by my Opinion the only fair Option for the Use of Eugenics. However this is where the Power of Eugenics ends: there are many People with "hard" mental Traits, that live a perfectly virtuous Life; having Eugenics to kill these People based on these Traits is definitely not an Option since they they are integral Parts of our Society as well as we don't know what the Nature designs for these Traits: *The Disability of today is well possible to be the Advantage of Tomorrow or even protects the Health from something more sinister.* [22] . It is just, that we must to guard our social Net as Species and punish the unsocial Behavior, but also remove repeated Criminals or Criminals of heavy Crimes since they pose an immediate Danger.

In Short: Technologies for genetic Selection offer Solutions to the Problem of Disease as well as Challenges to the Use of Technology to produce a Customization of the Offspring. I am against such a Customization. I am in Favor of capital Punishment for heavy Crimes or large repeated Crimes.

29.10 Civilizations before us

Atlantis, Thule, Lemur. These Names made me as Kid to shiver, since a Collection of Books on Paranormal was always available to any BookShop.

Plato, wrote in Timaeous a Story about Atlantis as a Kingdom where the Ascent was followed by Descent and moral Decadence. In ancient Greek, Chinese and Roman Literature, the Mythology offers the Capacity of a Metaphor concerning the Investigation of Ethics and Morality, something that is frequently found in such Texts. Some People decided that there are Indications of the Existence of these Civilizations, in particular for Atlantis the Gold that Atlantis accumulated through its Wars [23] , was always an Appeal for Investigation.

Thule and Lemur are also some Names that follow in Mythology, where for Lemur there was one Book that I don't remember and I won't mention, surely there are Sources out there.

We don't know if these Countries or Continents were real. Officially and with StateSupport, these Names were investigated by the National Socialists and here where their Story ends.

And here is the big Deal: while officially these Stories are considered by mainstream Science as Mythology, there were and are Investigations about these Stories by private, large Organizations as well as secret Agencies. The Story here however is of great Importance and must be understood.

If a Civilization perished before the official historical Narrative, then its Effects can be traced to our Society. This can open the FloodGates of our History with every Moron suggesting a Narrative that can literally bring **our** Society in Ruins since the People are driven by Myths, as someone said. I am too tired to trace the Citation, I have pain.

If a Civilization perished and this Civilization was technologically advanced, then the Existence of technological Artifacts by this Civilization can cause technological Upheaval, both by examination of the newly found Technology and Application of the Technology to our current Demands as well as searching of old technological Artifacts by StateActors of malicious Intend.

Keeping these two Things in Mind, it is better to consider the Consequences of Atlantis being real. If Atlantis is real, is more likely that the Great Powers search the World of technological Artifacts to secure them from an otherwise **ugly** Use by evil People.

[22] This is currently the Focus of Research of some Diseases that indicate that they cause an anticancerous Effect.

[23] See [Plato, Kritias]

29.11 UFO

I will not offer here any Research, please Consult the Hearings, Reports and official WitnessTestimonies of the Phenomenon.

UFO, AKA unknown flying Object, is a Term for any flying Object or Phenomenon that we don't know its Origin. Due to the Nature of such a Phenomenon, many Researchers as well Swindlers decided that such an Object is of extraterrestrial Origin. Whether this is true or not, there are Indications that these Objects are made and consequently are not a natural Phenomenon.

Governments through the Decades after 1947 denied any Claims of the extraterrestrial Origin of the Phenomenon and only recently they started slowly to give more Information about the Subject.

While a Contact with an extraterrestrial Civilization is a fundamental Contact that will define our Relation as a Civilization and Species with another one, there are on my Side some Reservations if this will happen.

The Aspects of Religion and Politics are the ones that currently affect our Life on Earth. Behind them there is a large History and an even larger BodyCount of Dead left behind by Religion and Politics. Here are my Questions to you:

- Do we feel safe to acknowledge a religious or political Superiority from the Side of the Extraterrestrials?
- What are the Intentions of the Extraterrestrials concerning Earth and its HumanSpecies?
- Do the Extraterrestrials share their Technology and under which Terms?
- Who is the Representative of Earth concerning the Contact with the Extraterrestrials? United Nations, USA, Russia or Christopher Neufelt who offered them a Glass of Beer and now the extraterrestrial Delegation is dead from Poisoning?

The Contact with Extraterrestrials probably will never happen. An advanced Civilization will not risk to disturb another Ecosystem or to arm another Civilization, who has a very malicious Past and Present, with Technologies. We are still struggling of the German Technologies that never saw the Light after 1945, see [Stevens], and we will struggle much more with Technologies that have larger ethical Implications.

It is my Opinion that any Observation of the Earth by Extraterrestrials is done for observing the Ecosystem of Earth. **No Alien wants the Contact with Idiots!**

29.12 Slavery, Technology and Freedom

I will roughly define Slavery as the Abuse of Persons for Profit. By Definition:

Def. 29.12.0.1*:* **Slavery (Innovative Ways of Abuse):** as the total Subjugation of a Person to another Person as a Mean of Gain by Abuse.

While Slavery was applied by all Civilizations and Cultures of the World, it was eventually the Europeans that abolish it, both in Europe and USA, and then this Abolishment became a global Effect, enforced on the Colonies and then to independent States with the last SlaveMarket in Europe about 1920 (Constantinople, Turkey) and last official Slavery in Saudi Arabia in 1962 under Pressure by the United Nations. The first Abolishment of Slavery was done by my Opinion for the two Reasons, the first to demonstrate moral Superiority by otherwise "hard Core"-Capitalists and the other was the Replacement of Slaves by Work of Machines, where the Slaves are now delegated their Responsibility of their Slavery to themselves: it costs less to the Master to have the Slave paying himself his medical Costs, Housing, Food and Family than the Master to oblige to the Law for

all these Benefits: yes, the Slaves must to be healthy so that they perform optimally their Tasks.

Slavery has an intimate Relationship with Technology and I have to describe it. Slavery is not bad as Abuse itself, since most of the Humans in their LifeTimes will eventually abuse another Person, this is Part of Reality of being "Human". Slavery is bad, because makes the Masters incapable to make something themselves but instead delegates their Effort to the Slave. Similarly Technology is our modern Slave where we abuse for Tasks that should we carry. And there it comes the Freedom: while a Slave does not have Freedom, the Master sacrifices his Freedom, i.e. the Capacities and Abilities he has, in Order to maintain the Slave, and consequently gain Time and Effort; in Reality, the Master becomes himself a Slave to his Laziness. Technology is good only for the Parts that are really critical, such as Medicine, Safety among others. Technology however should not be the excuse for our Laziness.

Speaking of Freedom, I define it according to a spiritual Teacher of mine which I will not mention [24] :

Def. 29.12.0.2*:* **Freedom:** is the Ability to serve the Necessity.

For me Freedom is not a Right, since a Right is given by Consensus and Consensus is not an Estimator of yourself. Freedom is Part of any Entity that has Autonomy and Intelligence and by confronting new Demands, will essentially service these Demands by choosing which demand is necessary. E.g. Schools don't need Computers; The Student should learn with Paper and Pencil and only in very specialized Schools, outside the normal Environment there will be Computers. In this Way the Student gains his Independence from Technology.

[24] My spiritual Teacher defined "Freedom" as "to do what must to be done".

29.12.1 Bibliography on Magic, Paranormal and the Rest

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Part: Symbolic Notations for Informatics

Chapter 30

Extended "Backus Naur"-Form. EBNF

30.1 Narrative

To describe a Language there are two ways, one to get the Grammar and Syntax of the Language itself and the other is to employ a Metalanguage for its Description, with the Former pointing to Language Studies (e.g. French Language), and the Latter pointing to Linguistics (the Science of what constitutes a Language).

Def. 30.1.0.1*:* **Metalanguage:** is a CommunicationSystem for describing Languages.

The Backus (and) Naur Form, BNF, is a **NotationSystem** for communicating the **Syntax of a ProgrammingLanguage of a Computer** and is an important Aspect since it allows you to understand the deep Parts of a ProgrammingLanguage in particular what is permitted and what is not permitted.

I said the Word "Aspect", meaning of Course, a Part of something. A ProgrammingLanguage has a second Aspect which is the what it tries to model, i.e. A ProgrammingLanguage models a Process that needs to be automatized.

E.g. The Language "C" was invented to model the ComputingProcesses for an OperatingSystem.

E.g. The Language "VHDL" was invented to model digital Electronics.

Within the Context of this Chapter I examine the Extended BNF AKA EBNF.

I include in this Chapter as an alternative Reference the Effort of **Dr. Richard E. Pattis**, see `https://ics.uci.edu/~pattis/misc/ebnf.pdf` as a parallel Text on the same Subject, though I give my Interpretation of BNF, for Comparison.

Question

What is a Metalanguage?

30.2 The "Backus and Naur"-Form

The "Backus and Naur"-Form, AKA BNF is a Metalanguage used in Descriptions of ProgrammingLanguages for Computers similarly to the Way that in Mathematics, the algebraic Equations are used instead of arithmetic Equations: *A BNF represents the general Rule, while the actual Code for a ProgrammingLanguage represents the Implementation of the Rule.* As such, BNF is defined:

Def. 30.2.0.1*:* **BNF:** the **Backus and Nauf Form** is a metalinguistic "Syntax"-NotationSystem for representing the Semantics and Syntax of formal Languages in particular ProgrammingLanguages.

A small Diversion here on the Term **"formal Language"**:

Def. 30.2.0.2*:* **Formal Language:** is a fully defined Language, almost always associated with Computer- or ProgrammingLanguage and intends to model the Communication between Human and Computer within the Limits defined by the Process being modeled.

In other words, BNF is a Notation for representing a ProgrammingLanguage but not using the actual ProgrammingLanguage. In this Sense, with BNF you describe the legal Syntax of a ProgrammingLanguage [1]

Remark 30.2.0.1. Because BNF, EBNF have many Variants, when you model a ProgrammingLanguage, you are allowed to remove or append Aspects of BNF as long as the "BNF"-Description allows fully the "ProgrammingLanguage"-Specification.

Having this in Mind, you should keep the Things always tidy.

30.2.1 History of BNF

John Backus, for the Definition of the Fortran Language, created in 1959 the Metasyntax, Peter Naur who later was working, in 1960 with Backus in Algol, cooperated to create BNF while Wirth [2] in 1977 created the first Extensions for BNF, called EBNF.

Backus was initially working in Algol for the Definition of the International Algebraic Language, IAL, which was an algebraic Notation. He defined IAL in Terms of a Metalanguage and this Attempt, open the road to the BNF.

Questions

1. What is the BNF?
2. What is a formal Language?

30.3 Describing a ProgrammingLanguage

30.3.1 The Parts of a Language

People mostly communicate either by Speech or by written Text by using a Language [3] . As long as their Objective is clear, the Language resolves most of the Disputes (what is known as either **common Sense** (or Consensus) or **Survival of the supported Opinion** (or Survival of the Strongest)). However, a Language is limited in Capacity, and when the People need to describe Rules, then the **Interpretation of Rules** is left to People trained to resolve them: these are the **Lawyers** [4] . The Lawyers can interpret the same Rule in different Ways, and there are many Cases in JusticeHistory that describe this Aspect.

Communicating with Computers is more difficult since the ProgrammingLanguage must be grammatically, syntactically and semantically correct so that the Computer will perform exactly what is required.

Grammatically means that there are KeyWords that must be written precise. A KeyWord is a Word that represents a Command to a Computer regarding a very specific Action by the Computer. By Definition:

[1] The legal Syntax has actual Consequences. What if you write a Code for a nuclear electric Plant and there is an Accident which your Code took a Part? The CodingManuals and the official "Coding"-GuideLines list the Codes and they can have actual Consequences to **YOU** and your Colleagues and ultimately your Family. Why do you think ATM-Engineers don't sleep well at nights?

[2] **Hop Hop Schwiz!** R.I.P. Niclaus Wirth, he died in 2024 January the first.

[3] I will not go to Anthropology for other Forms of Communication. Please if you interrupt again, come with your Parent!

[4] Yes, we hate you and beg you for Forgiveness.

Def. 30.3.1.1*:* **KeyWord:** is a ProgrammingCommand to the Computer for a specific Action to be taken.

E.g. In the ProgrammingLanguage VHDL, there is no Difference of uppercase and lowercase Words. In ProgrammingLanguage C++ there is Difference. And more: *there is only a Subset of HumanWords that are used to describe a ProgrammingLanguage.* For C++ there are only 63 KeyWords derived from the English Language while in VHDL (Version 1987) are 81.

Syntactically means that the KeyWords as well as other Words, must be written according to PlacementRules within the Sentence in Association with other Words.

E.g. the "HumanLanguage"-Sentence "I water need" is grammatically correct but not syntactically. For the C++, a Statement with a Form like "If Condition Statement" is a syntactically correct. See the Graphic from the MotionPicture "Naked Gun" 30.1 to understand how important is the Syntax.



Figure 30.1: Being Dyslexic is a Problem if you are working as a Printer for a Newspaper. Picture from Movie "Naked Gun 2 1/2" Paramount Pictures 1991. A Problem with Dyslexics is the false Syntax, which you might have noticed even in my Text.

Semantically means, that the Language must convey the correct Meaning of the described Operation.

E.g. While the Command of a PoliceLeader is "Remove all Suspects from an Area", the Meaning of the Command is ambiguous: to the Policeman this means "to arrest the Suspects", while to the "Trigger happy"-Policeman this means "to kill the Suspects". To make the things worst, in a very short but extremely intense civil Disturbance, the "normal" Policeman will interpret it as "to kill the Suspects" due to the Emergency of the Situation! While this Example seems extreme, you must to contemplate that by dealing with critical Infrastructure, the Room for Error, in particular when deals with Loss of Life, is very narrow. The Semantics of a ProgrammingLanguage are not an easy Task and as a ComputerProgrammer you should take into account these Semantics.

We can describe all these Aspects of Language, as a Hierarchy, see the PyramidDiagram 30.2, where the Meaning (Semantics) is the most important Aspect of the Pyramid, being at the Top.

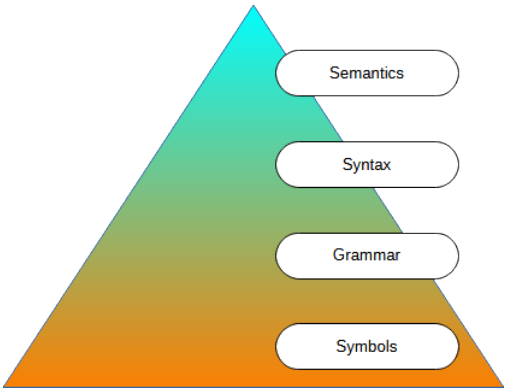


Figure 30.2: The four Aspects of Language as a Hierarchy in Shape of a Pyramid. Note that the Semantics are the TopAspect that is required, i.e. what we precise mean to convey. Since Symbols precede Grammar, I have included them despite the Chants of the Linguists around me at the Stake ('*'Burn him!, Burn him!*").

30.3.2 The evolution of Programming

The Man created Calculators with the Purpose to reduce the Duration and Effort of mathematical Operations. Because the Evolution of Calculators is proportional to the technological Evolution of Civilization, the Complexity of Operations increased and as such, the Processors, that is, the advanced Calculators which are associated with **ProgrammingLanguages** appeared. I will try to hide some Details here: historically speaking, the first ProgrammingLanguages were **AssemblerLanguages**: these Languages describe a Subset of a Vocabulary with each Word describing the OperationType (in Form of *imperative Verbs*, such as: **move, jump, clear, set** etc.) that the Processor must apply to the Data by viewing them as organized Entities. Once the Computers became faster and more refined, the **procedural ProgrammingLanguages** appeared which they simple describe with each Statement a Group of **"AssemblyLanguage"-Operations** -worth to know that the procedural ProgrammingLanguages provide a mechanism for describing and networking ComputingProcesses. Then came the **"Object oriented"-ProgrammingLanguages**, which describe ModelingConcepts and thus encompass a higher ProgrammingLevel. Beyond ProgrammingLanguages we have the **Semantic Programming** where *Meaning* is given as Input to a Computer (in a formalized Manner) and finally **Natural LanguageProgramming**, with the Computer understanding precisely what the Man means: for the Time this is a Dream in Progress, currently in its Infancy [5] .

The Diagram next 30.3 describes the Hierarchy of ProgrammingLanguages. The Attempts for each LanguageType overlapped during their Development since Informatics as Science does not obey the natural Laws that we have in our Environment, though [Zuse] [6] was of another Opinion as he speculated that natural Laws are discrete and obey the InformationTheory in the lowest Level. Chronologically the Languages at the Bottom appeared in a standard Form before the Languages at the Top.

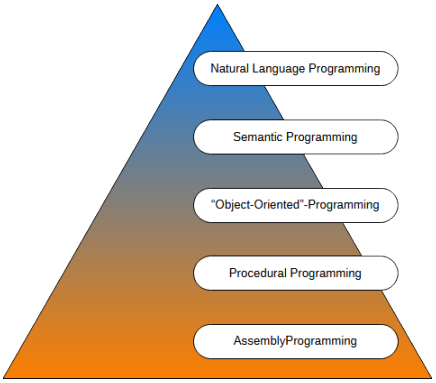


Figure 30.3: The five different ProgrammingMethodologies, hierarchically arranged.

30.4 The extended "Backus Naur"-NotationForm

A ProgrammingLanguage has many Elements, and for almost two Decades there was no standardized Notation to describe them, leading to Misunderstandings between Experts. The **Extended Backus Naur Form**, **EBNF**, is a Notation that describes the Grammar and Syntax of the ProgrammingLanguage, and serves as the Notation of Choice for creating ProgrammingLanguages as well as reading **Language ReferenceManuals**, AKA **LRM**

[5] I am editing this in 2025, and even if the large Language Models seem to be live and kicking on processing Commands and Sentences from a Person, the scientific Discipline of natural LanguageProgramming has a long Way.

[6] Zuse, Kondrad. Calculating space. MIT Technical Translation, 1970. CN: the German Title is Rechnender Raum. Vieweg, 1969.

of ProgrammingLanguages. An LRM is a Document that describes a ProgrammingLanguage. I define it as:

Def. 30.4.0.1*:* **Language Reference-Manual AKA LRM:** is a Document formed by a Commitee of ComputingExperts for defining precisely the ProgrammingLanguage (i.e the Programminglanguage that was already existing).

Thus, an LRM is the official "ProgrammingLanguage"-Manual for the Description of a ProgrammingLanguage. As a Document it has a **legal Value** i.e. it shows the correct Linguistic Interpretation that must be accepted by a Computer as well as it can be used in a legal Environment such as a Court of Law. How the Programmer uses the Language is left to him and the Contract he must fulfill. Perhaps he wants to procrastinate on ErrorMessages... A Legend notes that an Engineer will lose his Hair if he reads an LRM for Fun, and the Author testifies it.

Though there are some ProgrammingLanguages outside, that they will probably remain the same for the next Decades, there will be always a Production of ProgrammingLanguages in order to address Aspects of a Process in Need. Thus, you cannot avoid to learn the EBNF [7] . Keep this Thing in your Mind if you want to remain on the Edge with your Sanity intact [8] .

I will start with some Definitions and then I jump to some Examples.

30.5 Overview of Symbols

This Section is just an Overview for you to keep Pace, similar to a Guy, that before he enters the Jungle, looks from above to determine his Path [9] . Clear Explanations and Definitions are given through the Text, but I will include the Definition of BNF-Statement and BNF-Expression, which are the Foundations of BNF. For the Reason of Compatibility, I keep the Terms and discriminate them when I speak on EBNF.

A ProgrammingLanguage defines the Structure, the Statements and their Interaction in a ComputerProgram. The Core of modeling the ProgrammingLanguage is the **BNF-Statement** which defines how a ProgrammingConcept maps to the ProgrammingLanguage. This is defined as:

Def. 30.5.0.1*:* **"BNF"-Statement:** is a Statement, (i.e. a descriptive Sentence), used to describe a ProgrammingConcept relating to a ProgrammingLanguage that needs to be modeled.

The BNF-Statement consists of two Parts, the ProgrammingConcept and the BNF-Expression, where the ProgrammingConcept is defined by the BNF-Expression.

A **ProgrammingConcept** is a Model of a Task that the ProgrammingLanguage **must** implement.

E.g. A ProgrammingConcept is "how to read Data from a Computer". We can write this Concept without the Word "How" as: **Read Data from Computer**. How this ProgrammingConcept is implemented in BNF is Part of the BNF-Expression.

A **BNF-Expression** is a Combination of Items that either implements or performs the actual ProgrammingConcept. It is defined as:

Def. 30.5.0.2*:* **"BNF"-Expression:** is a Combination of Operators and Operands that evaluates to a ProgrammingConcept.

[7] Richard E. Pattis wrote, *"When teaching a rapidly changing technology, perspective is more important than content"*

[8] Mine is long lost!

[9] For those who have actually traveled, there is the old Saying which also applies here: Two Times the Man is happy towards Jungle: The first Day, as he enters the *Green Paradise*, and the last Day when he leaves the *Green Hell*.

Remark 30.5.0.1. The Operands in BNF-Expression are ProgrammingConcepts or other BNF-Expressions.

The ProgrammingConcept and the BNF-Expression form a Statement which contains the Symbol := AKA ::= which means "is defined". Consequently a BNF-Statement implements the Definition of a ProgrammingConcept.

E.g. If we had a BNF-Statement to define the Concept "Murder", then the Expression inside the Definition will evaluate to the actual Term "Murder" that we try to define.

E.g **Murder** := **is defined as the unlawful Killing.** [10] .

Though "Murder" does not concern a ProgrammingLanguage, the whole Idea here is that there is a Tool, that is BNF, that can be used to model the Processes that a ProgrammingLanguage intends to cover [11] .

The EBNF is written with Latin Characters and can be extended to any written Character or a Representation of Code for a Symbol that might be written, whether this Symbol is a CommunicationSignal or even the Content of a Harddrive, this is irrelevant, since in any Case written Characters will encode it.

The theoretical Background of BNF has its own Nomenclature, which might be intimidating. To solve this, I have to make here further Definitions that come from the Area of discrete Mathematics and Informatics.

The Contents of BNF have Mechanisms for describing ProgrammingConcepts as well their ProgrammingImplementation. The ProgrammingConcepts are called **NonTerminals** while their ProgrammingImplementation, i.e. ComputerCodes, are called **Terminals** and are Part of BNF-Expressions.

E.g. In CPL the Task of Writing something on ComputerScreen will be roughly written in "BNF"-Notation as:

```
<Print a Text on ComputerScreen>:=
   print"(" """<Text for Printing>"");";
```

which in actual ComputerCode that a HumanProgrammer will code will be for the Text "Enter Name:" as:

```
print("Enter Name");
```

Notice that some Parts where omitted! This is not any Problem, since the Idea of BNF is to use some Symbols for indicating some other Symbols.

E.g. The **double Quotes between a Symbol** indicate that there is a Symbol between them e.g. `"("`, while **two double Quotes enclosing one double Quote** indicate the Symbol of double Quote, as such it is used to enclose the Text that we want to print. Two double Quotes can enclose more than one Symbol, e.g. `");"` while the Semicolon at the End of a BNF-Statement denotes that the "BNF"-Statement ended. In Short, the BNF-Statement tell as: To print a Text on a ComputerScreen, use the "print"-Command, followed by left Parenthesis, then one double Quote, then the Text you want for printing, then another double Quote, right Parenthesis and the Semicolon.

Sometimes Terminals, i.e. ProgrammingCodes, can be repeated, selected, added with some Code that has a certain Form. In any Case there is a Set of Symbols, called Metasymbols [12] which can describe particular States and Operations

[10] In King James Bible, "Killing" is condemned and this affected the Common Law. In original Text of Bible, *"Murder" is condemned*, οὐ φονεύσεις, not "Killing": the Consequence of this is that you are allowed in Christianity to kill for Selfdefense but you are not allowed to murder. If you want to control a Population, you start from his BeliefSystem, and this precisely was reflected to this otherwise "innocent" Change in the biblical Text.

[11] By the Way, while "Murder" is not a KeyWord in a ProgrammingLanguage, reports have been filed for autonomous Drones in the current Russo Ukrainian War (2022-2025, I am writing this Comment in 2025). Someone has probably written the Word "Killing" in his ProgrammingLanguage.

[12] The Prefix "Meta" means in ancient Greek "After" and in ScienceNomenclature is used to describe something *above* the typical Interpretation, in particular, something that describes itself.

of the Terminal- and NonterminalSymbols that are Part of the BNF-Expression.

E.g. The double Quotes are used for enclosing Text, while the the Comma is used for aggregating, i.e. bringing together, Items.

Now I can proceed deep into the Jungle [13] , and describe the following: the BNF-Expression evaluates to a Value. This Value is the Meaning of the Nonterminal-Word, i.e. the Meaning of the ProgrammingConcept.

Remark 30.5.0.2. The EvaluationResult of a BNF-Expression is a NonterminalWord.

In other Words, when an BNF-Expressions evaluates, it corresponds to the ProgrammingConcept that it describes.

30.5.1 NonterminalWords

In ComputerProgramming, before you create a ProgrammingLanguage you describe the Concepts behind the ProgrammingLanguage and then you define the Words as well as their Syntax used in the ProgrammingLanguage.

Usually when you encounter primitive Populations [14] you start to record their Words and their Syntax together with a WordTranslation and Interpretation. In ComputerTechnology you are in a worst Situation, since you need to describe Concepts of what a ProgrammingLanguage should do regarding a Process you want to model.

E.g. To describe in a ProgrammingLanguage the Process that describes a Bank [15] , you need to describe Terms such as Lending, Interest, Money, Date etc.

The Concept you are trying to describe is called a "Nonterminal".

Def. 30.5.1.1*:* **NonterminalWord AKA "Nonterminal" AKA "CategoryName" AKA "Stereotype" (in UML):** is a Word that expresses a Concept in a formal Language.

E.g. The Words "**Statement**", "**Expression**", "**Clause**", "**Identifier**" and "**Sentence**" are all NonTerminals. They are denoted within AngleBrackets. E.g. $< Condition >$ [16]

Remark 30.5.1.1. NonterminalWords are written using alphanumeric Characters and PunctuationCharacters.

Questions

1. What is a NonterminalWord?
2. How you will write the NonTerminal-Word "Category" in BNF?

30.5.2 TerminalWords

For their Use, ProgrammingLanguages can employ Symbols to represent Concepts. Humans use their HumanLanguage to convey Information and consequently the Symbols that they use are those given in their written HumanLanguage.

Since the Computer is very limited to his Capacity to understand and we are also limited in our Capacity to model [17] , common Words are used as Symbols in the

[13] *Since I leave, here is my Message: I love you Danielle. Say to the Kids that I departed by saying something Important.* This Joke refers to Pancho Villa DeathConfession of Course.

[14] in order to buy their Land and to give them Bibles, Laptops and Access to Internet, I will not consider the sexual Diseases of the Guys who supply Money to your Bosses, just follow their CharityOrganizations.

[15] You know, the Place where you go with Hopes and end up with Tears.

[16] Some Authors omit this Symbol (or any other Symbol) denoting Nonterminals. In my Opinion, this defies the Concept of Nonterminals, and is an ugly Practice since many Words have an ambiguous Meaning as Nouns, Adjectives or Verbs. i.e. Return (Noun) and return (Verb).

[17] This is like a Marriage between two Idiots I suppose.

Descriptions within a ProgrammingLanguage. These Words are called **"Terminals"** and are represented as "KeyWords" in a ProgrammingLanguage.

Def. 30.5.2.1*:* **TerminalWord AKA Terminal:** is a Symbol inside the ProgrammingLanguage serving as a Command to the Computer for a specific Action to be taken.

E.g. The "for"-KeyWord in C++, describe a Command to repeat an Action.

Terminals are described as they are without any additional Symbol to accompany them. For easier Reading sometimes are found printed in italic or bold Print. For our Purpose are found in double Quotes, i.e. "for" when are referred in a Text.

Question

What is a TerminalWord?

30.5.3 TerminalSymbols

In Order to define the actual Characters that we will use in a ProgrammingLanguage, we need to define a Set of Symbols that these Characters are based. This Set of Symbols is called **TerminalSymbols** and in ProgrammingLanguages is taken as the Set of alphanumeric Characters as well as PunctuationCharacters and nonvisible Characters named "Whitecharacters" (i.e. Blanks) as well as ControlCharacters. Punctuators in written HumanLanguage may have different Meaning in ProgrammingLanguages. EBNF uses Punctuators to define Syntax as well as Symbols and Punctuators in Languages.

Def. 30.5.3.1*:* **TerminalSymbols:** are the Symbols used to describe Terminals and are often taken as alphanumeric Characters, PunctuationCharacters, ControlCharacters and Whitecharacters.

Later, during the Definitions I will include these Characters.

Question

What are TerminalSymbols?

30.5.4 Metasymbols

Having the Capacity to describe a ProgrammingLanguage, an Issue arises of the Symbols used for the BNF-Description itself. There are two Types of Symbols used:

- Alphanumeric Characters and Punctuators
- Metasymbols

Alphanumeric Characters and Punctuators are used for the **Terminal-** and **NonterminalWords**. **Metasymbols** are Punctuators that connect, for a particular Context, the Terminals and NonTerminals in Service of Notation.

Def. 30.5.4.1*:* **Metasymbol:** is a Symbol that describes the metalinguistic Notation itself.

E.g. `<Car>::=RoadVehicle` where "Car" is a Nonterminal, "RoadVehicle" is a Terminal and ::= is a Metasymbol which means "is defined".

For the EBNF we have the following Metasymbols:

- Termination, `";"`
- Definition, `"::="`
- StringInclusion, `" "`
- Selection AKA Alternation, |
- Optional Sequence, `[ ]`
- Concatenation, `","`
- Repetition, `{ }`
- Recursion, *see Text further*
- Grouping, `( )`
- Comment, `(* *)`
- Exception, `-`

- Special Sequence, `? ?`

Some Words need to be defined in Order to make lighter the Transition to this Notation.

An **Identifier** is a Name that is used to describe a Code or a Datum.

Def. 30.5.4.2*:* **Identifier:** is a Symbol represented by a Name that has the Purpose to identify Code or Data.

The Identifier within a ProgrammingCodeFile is often called "Label", since it labels the following Code.

A **String** is a Set of Characters.

Def. 30.5.4.3*:* **String of Characters AKA String:** is a Group of Characters consisting of one or more Characters.

Though not formally Part, but there can be an *empty* String, containing nothing, not even SpaceCharacter.

Typically a String will contain Alphanumeric Characters and Punctuators but everything that can be represented in a Form of a Code is allowed. A String is used to represent Data, and a close Synonym to HumanLanguage is "Word".

A **ProductionRule** is a Manipulation of Operands that produces something.

Def. 30.5.4.4*:* **ProductionRule:** is an Expression used to produce an intended Result.

The ProductionRule is an Expression that shows how the actual "ProgrammingLanguage"-Statement is implemented. It corresponds in Mathematics to an algebraic Expression.

Having now an Idea about the Context, I can describe the Metasymbols.

Questions

1. What is a Metasymbol?
2. What are the BNF Metasymbols and their Names?
3. What is a "BNF"-Statement?
4. What is an Expression in BNF?
5. What is an Identifier?
6. What is a String of Characters?
7. What is a ProductionRule?

30.5.4.1 Termination

The BNF-Notation uses a Terminator to end up a Statement.

Def. 30.5.4.5*:* **Termination (BNF):** is the Ending of a "BNF"-Statement.

The Semicolon, `";"`, is called "Terminator" and describes that the BNF-Statement ends. It is appended at the End of the "BNF"-Statement.

Remark 30.5.4.1. If a ProgrammingLanguage has a Semicolon as Symbol, then this Semicolon will appear enclosed in double Quotes in BNF, to distinguish it from the "BNF"-Terminator.

Question What is Termination and how is denoted?

30.5.4.2 Definition

A Definition is describes a Nonterminal as a Compound of Terminals or Nonterminals where the Compound is Part of the BNF-Expression.

Def. 30.5.4.6*:* **Definition (BNF):** is the Description of a NonTerminalWord in the Form of a "BNF"-Expression.

The `"::="` is called "**is defined as**" and describes that a Definition of a Nonterminal (i.e. a ProgrammingConcept) follows.

E.g.

```
<Written Word>::=
   <One or more Characters>;
```

[18]

This “BNF”-Statement tell us that a written Word will consists of one or more Characters. E.g. the Words “a” and “Car” are Examples of this BNF-Statement. Note that the “BNF”-Statement ends with the Terminator.

Question What is Defininion in BNF and how is denoted?

30.5.4.3 StringInclusion

A String can be included in a BNF-Expression to denote a particular Operand.

Def. 30.5.4.7*:* **StringInclusion:** is the Inclusion of a String in a “BNF”-Statement by means of “BNF”-Symbols.

In BNF, a TerminalWord is defined by the Use of the String. To define a String, BNF uses double and single Quotes as InclusionMarks, i.e. ’ and " ", where the single Quote AKA “Apostrophe”.

I use in my BNF-Notation single Quotes for single Characters and double Quotes for anything larger than one Character. In my Opinion (affected by my Programming in C, C++) this is the best Way to discriminate single Characters. In actual written Text, I try to adhere to the American English Rules of Double Quotes.

E.g. StringInclusion of Single Character:

```
<The Character "Gee" in lowercase>
   ::='g';
```

E.g StringInclusion of many Characters:

```
<The KeyWord "class" in C++>::=
   "class";
```

Remark 30.5.4.2. Large Strings are allowed to be continued to the Lines below without loss of Meaning, as long as the Terminator is declared at the end of the “BNF”-Statement.

Remark 30.5.4.3. Large Strings require Indentation of Text for meaningful Interpretation.

E.g.

```
<The KeyWord ‘‘class’’ in C++>::=
   "class";
```

Question What is StringInclusion and how is denoted?

30.5.4.3.1 Space between Words and Space as Metasymbol Every Nonterminal in a “BNF”-Statement can have within or outside it a Space. Statements using Terminals have also Space between Terminals, and in electronic Typography, this Space corresponds to the “Space”-Key.

Within a Nonterminal, the Space is typed as is, no surprises here. Within a “BNF”-Statement the Space is implied; however you might need to enclose it to describe a “ProgrammingLanguage”-Statement that uses Space. There are three ways plausible:

- You simple type **Space** between Terminals and NonTerminals
- You enclose Space within two double Quotes when is needed, i.e. “ ”, but this can Cause Problems of Interpretation.
- You enclose a special UnderscoreCharacter to denote Space, i.e. “_”

Strictly Speaking is better to imply Space, i.e. just push SpaceBar on the Keyboard, but is also good to declare in your Document, that Space between Words is implied [19]

[18] This “BNF”-Statement is actually described in a different Way as shown, keep reading.

[19] You will feel better, you will grow rich, you will open a GayBar where you will meet your future Husband together with his inflatable Sheep. Understood...

30.5.4.4 Selection

In BNF a "Selection" (AKA Alternation) is the Act of Choosing between two or more possible Outcomes.

Def. 30.5.4.8*:* **Selection AKA Alternation (BNF):** is the Act of Choice on a particular Item in a "BNF"-Statement.

The Selection is denoted with the vertical Bar, |, called "OR" and describes the Word (i.e. the linguistic Conjunction) "or" in an inclusive Manner, i.e. **This or the other or both** [20] .

E.g. An Alphabetic Character is defined as either lowercase or uppercase.

```
<Alphabetic Character>::=
   <Lowercase Character> |
   <Uppercase Character>;
```

While the Alternation denotes "this or the other or both", you must be conscious that sometimes it might be meant as "exclusive OR"; as always keeping the Eyes on Context can save much. The "exclusive OR"-Situation rises either by false Use of a ProgrammingConcept or by special Meaning.

Question What is Selection in BNF and how is denoted?

30.5.4.5 Optional Sequence

Sometimes you might need to declare that some Items are optional in BNF-Expression [21] .

Def. 30.5.4.9*:* **Optional Sequence AKA Optional Items:** is a Sequence of Items that are allowed to be included in addition to the main Items of the "BNF"-Statement.

The optional Sequence is denoted with Brackets, [ ], called "Optional Items" and lists the Items that are allowed for Use.

```
<Integer>::=[+,-]<Digit>;
```

E.g. if a ProgrammingLanguage allows you to enter Integers, then the Values, +2, -25, 7 are all valid.

Question What is optional Sequence in BNF and how is denoted?

30.5.4.6 Concatenation

Sometimes we need to link Symbols together so that they form a large Sequence. This Linking is called "Concatenation".

Def. 30.5.4.10*:* **Concatenation (BNF):** is the Linking of two or more Symbols.

Within BNF, Concatenation is denoted by Comma, ",".

E.g. One 3-Letter KeyWord is a Set of three Letters together.

```
<KeyWord>::=
   <Letter>,<Letter>,<Letter>;
```

E.g. For a KeyWord, the Words "abd", "sfg" and "ezr" are all valid.

Question What is Concatenation in BNF and how is denoted?

30.5.4.7 Repetition

Sometimes an Action described in a "BNF"-Statement is required to be repeated. Repetition is simple the Act of doing the same Thing [22] .

Def. 30.5.4.11*:* **Repetition (BNF):** is the Act of doing the same Operation.

The Braces, { } also called "Repetitive Items" and list zero or more Items intended to be repeated.

E.g. One Word with a single or many Characters made of the letter Q:

[20] The LogicTerm here is "inclusive OR".

[21] Something like declaring your Mother in Law to be Part of your HoneyMoon. Its an optional Part, though only suicidal People will accept it.

[22] I will not mention here your daily ProcrastinationRoutines since is not of Interest here, neither you.

```
<Word with one or
   many Character 'Q'>::=
      Q,{Q}
```

Implementing this "BNF"-Statement leads among the following Possibilities:
QQQQQ, Q, QQQQQQQQQQ, QQ [23]
.

We can of course enumerate by Amount these Possibilities, but *this is our Task in this Case*, not of the "BNF"-Statement:
Q, QQ, QQQ, QQQQ, QQQQQ etc.
Sometimes three Dots are used as a Symbol to refer to the previous Identifier:

```
<Word with one or
   many Characters 'Q'>::=
      Q,{...}
```

This is the same as before with `Q,{Q}`

Question What is Repetition in BNF and how is denoted?

30.5.4.8 Recursion

Recursion is the Act where something is called to operate on itself with the Resources that it has including itself. For Example, if a Boss ask for a Worker to do something many Times, then the Worker might as well for himself take the Role of the Boss in order to finish his Task, i.e. the Worker by Use of Selfconversation commands himself(!). Therefore:

Def. 30.5.4.12*:* **Recursion:** is the Act of calling itself.

In BNF the Mechanism of Recursion is described by using the Nonterminal inside the Definition of the Nonterminal.

E.g. To describe an alphanumeric CharacterSequence use either an alphanumeric Character or one alphabetic Character or one Digit or anything of the three including either one Alphabetic Character or Digit.

[23] Notice that the Comma here, is Part of the Implementation of the ProgrammingLanguage and represents a Separation of Items.

```
<Alphanumeric Character Sequence>::=
   <Alphabetic Character>|
   <Digit>|
   <Alphanumeric Character Sequence>|
   [<Alphabetic Character>|<Digit>];
```

E.g. We can implement according to this Definition an Alphanumeric CharacterSequence as, "b" (One Character), "8" (One Digit), "7Q" (one Digit and the Option "Character"), "z5" (One Character and the Option "Digit"), "12g65Qghtr6" an Alphanumeric Sequence created by the Repetition of this Rule.

Question What is Recursion in BNF and how is identified?

30.5.4.9 Grouping

Grouping is to place Items together so that they form an new Item. By Definition:

Def. 30.5.4.13*:* **Grouping AKA Aggregation:** is the Act of collecting Items into one Entity.

BNF uses as Grouping the Parenthesis, `"( )"`, within which Items are included to Form one Entity.

E.g. The Form of an Identifier is defined to include a String of 3 Characters, an Underscore and a Value.

```
<IdentifierForm>::=
   (<3 Characters Alphabetic String>,
   '_'<Number>);
```

i.e. According to this ProductionRule, the Identifier "rTZ_23890" obeys the IdentifierForm. However these Forms of Identifier are invalid: _12 (no 3 Characters), trr6 (no Underscore between Characters and Number), fdf_ (no Number).

Comparing Grouping with Concatenation, in Concatenation you have the Linking of Items while in the Grouping you have the Collection of Items.

Question What is Grouping in BNF and how is denoted?

30.5.4.10 Comment

Even "BNF"-Statements need some Comments [24] . Comments should always be used sparingly, since you try to constraint your Effort to BNF, i.e. you try to place Information using "BNF"-Notation, not to place normal Comments which the will increase the Interpretation on the "BNF"-Statements [25] .

Def. 30.5.4.14*:* **Comment (BNF):** is a Sentence that shortly clarifies a difficult Aspect of the the BNF-Statement.

To include a Comment use the "Parenthesis-Asterisk"-Groupings, `(* *)` where inside you declare the Aspects in Need. The Comment is inserted before the Terminator.

E.g.

```
<Jim>::=<Idiot>(*Always!*);
```

Question What is Comment in BNF and how is denoted?

30.5.4.11 Exception

A ProgrammingLanguage can only model one "well defined"-Process, but unfortunately there are always Exceptions that must be modeled, so that the Model will not take into Account false Assumptions.

E.g. The Model of a MeasurementSystem for Length will essentially measure the Distance between two Positions. The Use of negative Values for describing Length is meaningless since Length is *always* positive. This ExceptionType needs to be modeled.

Def. 30.5.4.15*:* **Exception (BNF):** is a Part of the BNF-Statement that does not obey the ProductionRule.

The ExceptionSymbol in "BNF"-Statement is the Hyphen, "-". It is inserted within the ProductionRule.

[24] Similar to you all the Time!

[25] As Nietzsche said, "too many Interpretations is a Sign of Decadence", and adding Comments introduces another Level of Uncertainty.

E.g. Modeling the positive Numbers:

```
<Positive Numbers>::=
   <Naturals> - <Zero>;
```

Note: the Hyphen in Maths is used as Minus. Here there is no mathematical Expression (e.g. $5-0$) but a semantic Expression that excludes an Object.

Question What is Exception in BNF and how is denoted?

30.5.4.12 Special Sequence

Sometimes a special Sequence of Characters is required and in this Case the two QuestionMarks, ??, enclose such a Sequence. A special Sequence might be used to describe a String of Characters that are not defined otherwise.

E.g. Describing the ASCII Character of ACK-Code:

```
<ACK-Code>::= ?FF?;
```

30.6 Revision of BNF with respect to Notation EBNF

Here is a Revision to what I presented.

In [Estier] the Definition of BNF in Terms of BNF (WTF?) is given as:

```
syntax ::= { rule }

rule ::= identifier "::=" expression

expression ::= term { "|" term }

term ::= factor { factor }

factor ::= identifier |
        quoted_symbol |
   "(" expression ")" |
   "[" expression "]" |
   "{" expression "}"

identifier ::= letter { letter | digit }

quoted_symbol ::= """ { any_character } """
```

My Interpretation, avoiding as manly possible circular References. I include also some Aspects that I have encountered [26] :

```
Termination of BNF-Statement::=
   ";"

" "::=
   Double Quotes denote
   the Inclusion of an Item;

"* *"::=
   Double Asterisks denote
   a Comment within
   a BNF-Statement;

"? ?"::=
   Double QuestionMarks denote
   a special Code within
   a BNF-Statement;

"-"::=
   Dash denotes an Exception;

"is defined"::=
   "::=";

"|"::=
   Selection of zero
   or more Items;

"<"Word">"::=
   Definition of a Nonterminal;

<Nonterminal>::=
   A Word that describes a Concept;

<Terminal>::=
   A Word that describes
   a Part of a Concept or
   Implementation of a Concept;

<Item>::=
   <Terminal>|<Nonterminal>;

"..."::=
   <Zero or more identical Items>;
```

[26] Please don't ignite me on the Stake before Midnight.

```
<Repeated Item zero or more Times>::=
   <Item>{...}|<Item>{<Item>};

<Grouping AKA Aggregation
   of two or more Items>::=
      "("<Items>{,<Items>}")";

<BNF-Statement>::=
   (<Nonterminal>"::=
      "<Terminal>|<Nonterminal>|
         <Metasymbol>";");

<Optional Item>::=
   [<Item>];

<Optional Part of Item>::=
   <Item>[<Part>];

<Repeated Item one or more Times>>::=
   <Item>{,...};

<Concatenation of Items>::=
   <Item>,{...}|<Item>,{<Item>};

<Alternative Item one or more Times>::=
   <Item>{|...};
```

30.7 Implementation of BNF as Result

On this Part I examine some BNF-Statements for some ProgrammingLanguages providing the "LRM"-Equivalent that I encounter as well as the Correction if any. Notice though that even if the Type of BNF is used is different in some few Aspects, both Groups of Editors are consistent with their "BNF"-Variant which partially remedies their Notation.

30.7.1 The "if"-Statement in CPL

In **Subsection 6.8.4, "Selection statements"** [27] **(Modified to avoid the "switch"-Statement):** of the LRM

[27] ISOIEC Programming languages C 9899 1999

Standard of C PRogramming Language, the “If”-Statement has the Syntax:

```
selection-statement "if":
   if ( expression ) statement
   if ( expression ) statement else statement
```

The Committee decided for a BNF that does not require any AngleBrackets for the NonterminalWords, but instead went choose different Fonts! [28] The Statement will be made according to EBNF:

```
<"if"-SelectionStatement>::=
   if "(" <Expression> ")" <Statement>
   [else <Statement>];
```

Where the “else” is added as optional Sequence [*else* < *Statement* >] instead of two separate Statements.

Implementing the “BNF”-Statement is easy:

E.g. In C ProgrammingLanguage, say that I want an Expression that testx x for Equality with the Value of 12, and when it is Valid (i.e. x is actual 12), it does prints “This is Something”. Both Expressions and Printing can fit to the BNF Code. The Code is implemented as:

```
if (x==12) printf("This is Something");
```

A small Detail now for the Hawks: the “C”-Statement is terminated in the EBNF-Statement with Semicolon. Because the “C”-Statement originally is not defined in the “if”-Statement, i.e. `if ( expression ) statement` we must go to the LRM to find the Definition of a Statement itself! The original Definition does not show that a Statement is terminated also by a Semicolon unless you carefully see the Code about this, but we need to search the Manual for such Thing. In the Section 6.7 you can find the Semicolon implied in the Declaration as

```
declaration:
   declaration-specifiers init-declarator-listopt ;
```

[28] What is the Upgrade to our Product? We changed its Color! (Old Advert about Printers.)

and from that you should go to the Section 6.8 to determine the Form of Statement (!). **Lesson of the Day**: If you are reading an LRM you read it since you need to implement something that it has a lot of Detail: don’t rest assured about your Effort since the Devil is in the Detail.

30.7.2 The “if”-Statement in VHDL

In the digital Hardware of Critical Systems, the one ProgrammingLanguage that runs in the Microcontroller of the JetEngine that flies you, or in the Heart of your “Cyborg”-Grandfather is the VHDL ProgrammingLanguage. In Section 8.6 [29] the Standard defines the “if”-Statement as:

```
if_statement ::=
   if condition then
      sequence_of_statements
   {elsif condition then
      sequence_of_statements }
   [else
      sequence_of_statements ]
   end if;
```

Still this is better than the Example in C, but still, you should avoid in critical Descriptions the Ornamentation with BoldFonts. The Description of EBNF needs only few Changes with Nonterminals:

```
<"if"-Statement> ::=
   if <Condition> then
      <Sequence of Statements>
   {elsif <Condition> then
      <Sequence of Statements> }
   [else
      <Sequence of Statements>]
   end if;
```

Its Meaning of Course is clear: If a Condition is Valid then one Sequence of Statements will occur, optionally zero or more “elseif”-Statements can be added and as

[29] IEEE Standard VHDL LRM 1076 1987

single Option for an alternative Route of Action the “else”-Statement can be added.

An Implementation of this Statement is:

```
if (Reset='1') then
   D_Out<='1';
elsif (Clock'event and Clock='1') then
   D_Out<=D_In;
end if;
```

30.7.3 An Example of BNF in VHDL-Language

The VHDL ProgrammingLanguage models and implements actual digital Circuits that are used mostly in Complex Systems. As such, VHDL plays a great Role in the Market of Critical Components in particular Military Electronics for critical Applications. A HumanProgrammer who wants to work with VHDL **must** have knowledge of the ISO Standard of the VHDL Language, (LRM) which describes VHDL in Terms of BNF.

In the ProgrammingLanguage “VHDL” an “Entity” is roughly a digital Circuit. Say that I am looking at the LRM in order to design a digital Circuit with VHDL. The first Thing that I check are the KeyWords, so that I can distinguish them from Nonterminals. Having this in mind, I can proceed to determine the Code for “Entity”, which is represents the Structure of the Model of my digital Circuit. According to [VHDL LRM 1076 2008] [30] to declare an Entity I must consider in VHDL:

```
<entity_declaration>::=
   entity <identifier> is
   <entity_header>
   <entity_declarative_part>
   [ begin
      <entity_statement_part> ]
   end [ entity ] [ <entity_simple_name> ];
```

So what it is?

Here this “EBNF”-Code tell me that I have the Concept, i.e. the Nonterminal called “Declaration of Entity” (notice that I shifted the Sentence here) that is defined (::=) as the Code with the TerminalWords:

```
entity is
end;
```

The Brackets at the “End”-Statement are “entity” and “simple name of entity” and are both optional Parts of the associated Nonterminal and I can either write when implementing my Code as:

```
entity is
end;
```

or

```
entity is
end entity;
```

or

```
entity is
end <entity_simple_name>;
```

or probably also:

```
entity is
end entity <entity_simple_name>;
```

The Nonterminal ⟨entity_simple_name⟩ is a Name that I have to choose for my Programming. However is a little problematic the Name “Identifier” in the first Statement. “Identifier” and “entity_simple_name” is possible to refer to the same Thing, I don’t know at this Point. If I cannot find, I will need to get to other Pages of the same Document to resolve it. In the same LRM, the Section 3.2.3 has an “Entity” called “ROM” that ends with the Term “ROM”. I decide that the “Identifier” for the Entity is the same as “entity_simple_name”. This turns up to be true according to Codes that are available.

Inside the “Entity” I also have some Nonterminals, that tell me that are Header and declarative Part of the Entity.

If I further check the LRM I find that are also defined:

[30] Here I included AngleBrackets for the NonterminalWords

```
<entity_header>::=
   [<formal_generic_clause> ]
   [<formal_port_clause>]
```

Since both Definitions of the Header are optional Parts of the Header, then an "Entity" is possible not to need them in a Design. From my Experience I know that *Options are not necessary Necessities* [31] , so I will not include them for now.

However the Nonterminal called "entity_declarative_part" is definitely an Option.

```
<entity_declarative_part>::=
   {<entity_declarative_item>}
```

Within its Definition [32] I find the Nonterminal called "signal_declaration". Since I am Novice in my Endeavor to the VHDL, I find that a Signal can be also an electric Port. What do you know? The digital Circuit have actual electrical Ports that are used to pass electrical signals.

The next Part is:

```
[ begin
<entity_statement_part> ]
```

Finally the Brackets including the Keyword "Begin" and the Nonterminal ⟨entity_statement_part⟩ are together optional Parts of the "signal_declaration".

So I write my Code for my Circuit which is called "XCircuit" as:

```
entity XCircuit is
end XCircuit;
```

While I haven't implement much on this (e.g. Ports or the Functions), the whole Idea here is that by understanding the BNF, I can write correct Statements and solve Misunderstandings and Ambiguities.

While a Book on ProgrammingLanguage will report to you the Basics of Programming with the particular ProgrammingLanguage, it is the BNF of the ProgrammingLanguage that will help to understand all the inner Processes of a ProgrammingLanguage.

[31] Its Impressing how from Programming you can get Wiseness to create a Proverb...

[32] I don't include it

30.8 Suggested Bibliography on BNF

• [ISO 14997]. This is **ISO/IEC 14977: 1996(E)**, the Standardized Documentation for EBNF. If you are developing a ProgrammingLanguage or you get stuck in ugly Definitions is where you start your "Point of no Return" (I love you Danielle, but Nature calls).

• [Backus]: J.W. Backus, Syntax and semantics of proposed international algebraic language, Zürich, Switzerland, 1958, ACM-GAMM Conference. This is a somewhat complicated Paper in the Sense of omitting KeyConcepts, however is important, historically and practically speaking.

• [Estier]: Estier, Th. What is BNF notation?, CUI - University of Geneva, Switzerland. `http://cui.unige.ch/db-research/Enseignement/analyseinfo/AboutBNF.html` : This is a nice, very short Article about BNF in general.

• [Pattis]. Richard E. Pattis, EBNF: A Notation to Describe Syntax. Pittsburgh, PA, USA. `http://www.cs.cmu.edu/~pattis/misc/ebnf.pdf`: This is a very nice Paper to read if you are pursuing to study Informatics. It needs some Time to read though.

Chapter 31

The FlowChart

Narrative

The **FlowChart** is a Diagram that shows how either Intentions, Data or Materials are created, delegated, modified and controlled through a Set of Activities. Since Data or Material move through the Diagram, their Motion resembles the Flow of a Fluid, i.e. something with no particular Form, from a StartingPoint to an EndPoint.

The FlowChart is used by a Manager or a Technologist to reveal the Activities constituting a Process as well as the Configuration of the Activities. Once the FlowChart is laid, other Diagrams and Methods are employed to define precisely the Details.

As a Diagram, the FlowChart has passed various Interpretations and Revisions that sometimes make it difficult to handle. In Addition to that there was the UML-SoftwareModeling that gave it another Name: **Activity Diagram**. If that was not enough, UML extended the Meaning of FlowChart and even reduced some Parts of the original Meaning. What started as a good Intention, became a Nightmare of Confusion for Analysts.

Within this Chapter I try to stay to the original Definitions of FlowChart as were formed by [IBM] and [ECMA]. Saying that, I don't strictly stick to the Standards, but I use them as a Vehicle for Interpretation. I also reduced some Elements to make the Life easier and more focused; this is also the Reason of Bibliography, that is, the Comparison with what is written to this Book. An important Notice here: read normally this Chapter and understand the FlowCharts. Once you understand them, go back to understand the Terms and Definitions; these are important later in Management as well as SoftwareDesign.

Finally and for all Purposes: while it seems that the FlowChart might not have a useful Outcome to our very advanced, high Technology Tools and Processes in our modern World, it provides a simple Tool that even its Use forces the Designer to think about what he is doing. Consequently, it should be used for training of a Designer so that it gives him Clarity to his Modeling.

31.1 Introductory Terms

A **FlowChart** is a Diagram with a long history in industrial Documentation where is used for documenting a *Process as a Sequence of Activities*, the *Sequence's Logic* (i.e. the particular Judgment for selecting a Path) as well as the **"End"-Products made by a Process**. To fully define it, I need to define some Terms that are Part of Management and Systems.

Inside a Process exists one or more Activities, where the Activities are serially activated. The Term **"Activity"** has a dual Use making some Misunderstandings to occur. An Activity can be a **Task**, i.e.

something like a **BlackBox** with which signifies a Piece of Work to be done, but it can also be a **Duration** where something happens, i.e. an Event with a longer Duration [1] . Consequently there are two Definitions for Activity:

Def. 31.1.0.1*:* **Activity (WorkType) AKA Operation:** is single Task for a valuable outcome.

E.g. I will introduce now an Activity to the Class of Students, that is, we will sing [2] .

E.g. The Company assigned each Cell of Workers an Activity for managing the Process of creating the Product [3] .

Def. 31.1.0.2*:* **Activity (EventType):** is an Event taking place in a durative (i.e. for a Duration) Manner.

E.g. There is a recent Activity in the Sector 12 of the System, probably due to luck of Maintenance.

I said before that a Process is contains Activities [4] . The Process I formally define as:

Def. 31.1.0.3*:* **Process (FlowChart):** is a Set of one or more ordered or configured Activities that cooperate between them to create an "End"-Product which might be tangible or intangible.

E.g. The Process of Distillation consists of three Activities, the Boiling, the Cooling and the Collecting. Associated with each Activity are the ProcessorMachines Boiler, Cooler and Collector.

While the Process is defined as one or more ordered Activities, it is perceived as single Entity and this might give the Illusion that a Process constitutes a single Activity. This is not the Case, since a Process is always a Collection of Activities.

Inside a FlowChart, the Flow of a Material or Data is described as the Motion through Activities. This Motion is not a physical Motion, but rather a *Transition* from one Activity to the Next. Consequently the Term "Flow" is used, since the Material or Data or Intentions are formed yet.

Def. 31.1.0.4*:* **Flow:** is either the Movement from one Activity to another or the Sequence of Events.

An ActivityFlow concerns the Flow of "WorkType"-Activities as well as "EventType"-Activities. It is defined generally as:

Def. 31.1.0.5*:* **ActivityFlow:** is the Movement from one Activity to another.

Sometimes I will need to focus on pure Sequences of Events without to mention the Term "Activity", simple to give a particular Meaning to some Actions.

Def. 31.1.0.6*:* **EventsFlow:** is the Sequence of Events.

Having these Aspects of Process in Mind, the Definition of the FlowChart is here:

Def. 31.1.0.7*:* **FlowChart:** is a Diagram representing ActivityFlow.

The FlowChart is used to represent Activities, WorkFlows, industrial- or Service-Processes and Algorithms.

Finally in a FlowChart something flows and this is considered as a Material that is created, modified, stored, retrieved, deleted during its Existence within the FlowChart. This Material can be Data,

[1] The Perception of an Event is normally *spontaneous*, but actually an Event can also be long; however a long Event is more associated with a Phenomenon. Don't worry so much for Details now, since you learn; the Things are actually simpler, but the Definitions and Interpretations are vital for the scientific Progress as well the Transition to more robust Techniques of Modeling like UML.

[2] Sing Bastards, sing!

[3] Note that if the Workers are assigned a Task, this might be perceived as an "one Time"-Activity, while if the Workers are assigned an Activity, this might be perceived as a permanent Type of Task.

[4] one or more, later what this means.

actual Materials or Intentions [5] . By Definition:

Def. 31.1.0.8*:* **Material (FlowChart):** is anything that can be created, modified, stored, retrieved, deleted within the Activities of a FlowChart and includes Materials, Data, Intentions or any structured Combination of any of the mentioned Items.

Where Intention is defined as:

Def. 31.1.0.9*:* **Intention (FlowChart):** is a planned Activity.

31.1.1 A small Example on the IntroductoryTerms

A Factory produces LipSticks of various Colors by using Wax [6] , Oil, Alcohol and Pigments [7] . The **Process** of Production consists of many **Activities (WorkType)** between Groups of Workers in a **Flow** that includes unpackaging of Materials, preprocessing of Materials, mixing the Materials, containing the Material in a Tube, packaging the **"End"-Product**. A certain **Activity (EventType)** is to check the Quality of the Materials, before, during and after Mixing and Containment in the Tube, by passing through different Locations and sampling the Materials, as well as "End"-Products.

[5] How do you model "Intention"? Well the Term "Intention" might not be appropriate but rather "Logic of Action"; I had to place this Term since I could find any Documentation about how to describe the Terms of the Logic of a HumanAction in a FlowChart. FlowCharts are also used in Manuals to describe to a Person what to do, e.g. in an EmergencySituation.

[6] For the Girls (and the Boys that want to be Girls): Best Wax is Carnauba and has the highest Price. Good LipSticks will list their chemical Composition, but please bring a magnifying Lens to read these small written Text on LipSticks. I have not check if the urban Legend is true, but some Girls swear that LipSticks are also great to get Herpes by trying them in the CosmeticsShop since some Customers might have cold Sores. Yes, this Idiot (the Author) had also Girlfriends that will storm Cosmetics while the Idiot waits.

[7] For the Process I consulted [Schlager et al]

31.2 Types of FlowChart

FlowCharts are used in every ServiceIndustry or industrial Process where the Sequence of Activities must be explicitly maintained in a proper Order and according to required Conditions for the Activities. There are four Types of FlowChart:

- "Program"-FlowCharts
- "Data"-FlowCharts
- "Document"-FlowCharts
- "Process"-FlowCharts

The FlowCharts are defined as:

Def. 31.2.0.1*:* **"Program"-FlowChart:** is a FlowChart describing an Algorithm executed by an intelligent Agent.

An intelligent Agent might be a Computer or a Person [8] .

Def. 31.2.0.2*:* **"Data"-FlowChart:** is a FlowChart describing the DataFlow through a "DataProcessing"-System.

[ECMA, 1966] [9] .

Def. 31.2.0.3*:* **"Document"-FlowChart:** is a FlowChart describing the DocumentFlow in a ProcessingSystem.

The ProcessingSystem can be a Service or a "DataProcessing"-System.

Def. 31.2.0.4*:* **"Process"-FlowChart:** is a FlowChart that describes the ActivitySet that a Process consists to create an "End"-Product.

The general Purpose of Software is to model and control a Process. Because the increasing Digitization of daily Life blurs the Bounds between digital Computing and an actual automatized Services (whether Human or Machine), the

[8] Human, Fairy, Extraterrestrial, the Selection is large enough!

[9] Linguistic Modification is according to the Author of this Book, Neufelt Christopher.

FlowChart is recommended to be deployed in all Aspects of Development concerning Flow, whether Administration or MachineDesign. Thus, the Methodologies and Symbols provided can be essentially mixed in Order to accommodate proper Modeling of a real, everyday Environment.

31.3 The Drawing-Methodology of FlowChart

The DrawingMethodologies of FlowChart are by Hand, by either technical Drawing with Use of TemplateRuler or by Use of SoftwareApplications for Drawing, Automation. You should train to use your Hand, whenever possible, since the executive Functions of the Brain work optimally with your mental Functions of your Brain requiring Interpretation and Inspiration for the Modeling. Later when you have ready your FlowChart, you can make the FlowChart with TemplateRuler or SoftwareApplication.

Remark 31.3.0.1. The Direction of the FlowChart is from right to left, and from top to bottom. Exceptions are allowed if provide Clarity.

Remark 31.3.0.2. The BaseSizes for a FlowChart vary. A good Estimate is the 3 by 2 Ratio, 3 is the Length, 2 is the Width.

For my Diagrams, I use a 5mm Divisions "A4"-Paper with 3 by 2 Ratio on cm, that is 3cm x 2cm with Pen of 0.8mm Thickness [10] .

While the Dimensions and Ratios of Measures are given, these are just Options. Whenever you draw something, you should pursue its Clarity with respect to what you have, what you need to accomplish and the Time available. A clear Drawing, even by Hand, is much more better than a professional Drawing when is available at the right Time and the right Place.

31.3.1 Short Example on FlowChart

The following FlowChart is an Example of "Program"-FlowChart, the next is the "Data"-FlowChart. Study them for a Moment, try to understand them (without looking elsewhere in this Text) and then come back to the Text. This is an important Aspect of the FlowChart, the Ability to communicate even to People that don't have Knowledge of FlowCharts.

The first Diagram, 31.1, shows how HotelPersonnel processes a new Guest.

The second Diagram, 31.2, shows how Data stored are processed in a new Format.

The Symbols here are the most basic ones, as well as the most commonly found:

- The "rounded Edges"-Square denotes a Start and a Finish.
- The Arrow denotes Transition from one Shape to Another.
- The Square denotes an Activity.
- The Rhombus denotes a Decision.
- The Cylinder denotes DataStorage.

31.3.2 Macro and micro Focus

The Research on a Process will shift the Focus of the Researcher to large as well detailed Aspects of the Activities engaging in a Process. Not all Details can be serviced, and typically the Researcher will create FlowCharts that concern large and small Aspects of his Modeling.

E.g. He might create a DepartmentStore as a non detailfull Model and for each Subsection create individual Processes to fit the BusinessModel and the

[10] Sometimes the sweet Company of a Glass of Rum will not hurt either.

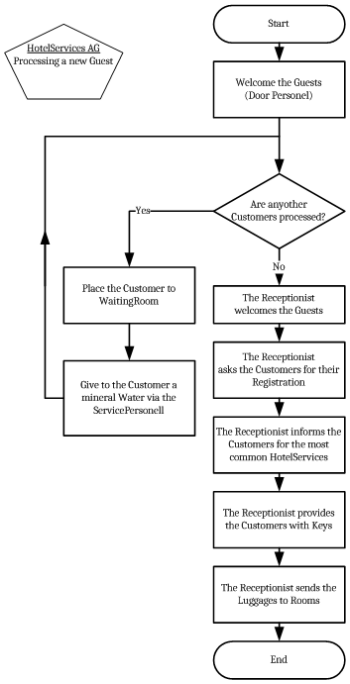


Figure 31.1: This is a "Program"-FlowChart where the Processing of a HotelGuest is indicated. While it seems that the Workers in a Hotel should know their "Trade", the FlowChart models each Process so that there are clear Responsibilities and Tasks. The Pentagon serves as a Label, but is not Part of the Notation. The Pentagon serves as a Label but in not Part of the Notation.

CustomerRequirements. In this Case, his Focus changed from Macro to Micro.

Remark 31.3.2.1. The Focus when designing a FlowChart should serve the necessary Details for the Processing of Data, Materials and Intentions. Any further Detail clutters the FlowChart and makes it problematic for Analysis and Design.

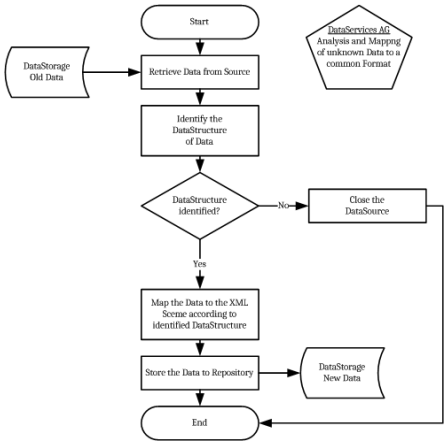


Figure 31.2: This is a "Data"-FlowChart where the Data from a Source are mapped to a new DataStructure and then Stored.

31.4 Categories of Symbols for FlowCharts

Meet the usual Suspects: the Symbols. The FlowChart contains five Categories of Symbols [11] , with the **operational Symbols** being the mostly used. In addition, there are Types of FlowChart which will impose constraints to the Symbols being used since there is a certain mixing of Symbols that can lead to distinct Categories according to the Context used. More of this will follow on the Examples.

The Categories of Symbols are:

- DataSymbols
- FlowLines
- Operational Symbols
- "FlowControl"-Symbols
- Auxiliary Symbols

Typically you should constraint yourself to the Symbols of Operation (Rectangle), FlowLine (Arrow), Decision (Rhombus) and Terminal (Pill), with the Rest

[11] Suspects, turn right so that the Witness can see ya!

of Symbols showing very specific Aspects, mostly dependent on Technologies available.

31.4.1 DataSymbols

As I said before when I was younger (about some Minutes ago!), the FlowChart displays the Flow of Items within a Process. A special Item is the Datum (Data for Plural), which must be modeled if its directly affected by the Process. A Symbol of Data is defined and represented as:

Def. 31.4.1.1*:* **DataSymbol:** is a Symbol that represents Data as well as tangible Items.

Data can be SoftwareObjects, DataFiles, Documents. Tangible Items can be Products, actual physical Events even biologically defined Matter [12] .

There are three Members in DataSymbols used and are the Following:

- The general Datum
- The single Document
- The "DataBase"-Symbol

31.4.1.1 The general Datum

A Datum is a Piece of Information. A general Datum is a Piece of Information that we can get available for Use and represents a Source of Data, a Destinatio for Data or a DataFile. It is defined as:

Def. 31.4.1.2*:* **General Datum:** a Symbol that represents a DataFile, a DataInput or DataOutput from a System or Product.

The general DataSymbol denotes a Process emitting or receiving Data. The Data can be anything in Size and Type. The Clarification or Implementation of the Symbol is denoted elsewhere. The Symbol for this is the non right angled parallelogram, shown in the Figure 31.3.

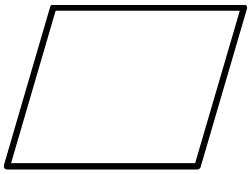


Figure 31.3: The general DataSymbol

31.4.1.2 The single Document

A Document is an Item that retains Data or Information for Use in a Process. It is defined as Symbol to represent Data or any other Item that retains Information:

Def. 31.4.1.3*:* **Single Document Symbol:** is a Symbol that represents a DataFile or a tangible Form of Information such as Document.

The Single Document is shown in the Figure 31.4. Sometimes you need in one Chart to show that more than one Document is demanded or produced, thus the Symbol of multiple Documents is done by copying and displacing the original Symbol two times on the back, see 31.5. The Dimension of the multiple Documents is slightly greater.



Figure 31.4: The DocumentSymbol

31.4.1.3 The "DataBase"-Symbol

A DataBase is an Item that holds, in an organized Fashion, Data. The Symbol of it represents:

[12] In the Engineering of War, a Process can produce Soldiers and another Process can consume Soldiers. I know that this is uncomfortable in many respects, but someone needs to model this. DroneWars anyone?

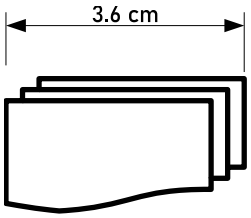


Figure 31.5: The “multiple Documents”-Symbol

Def. 31.4.1.4*:* **“DataBase”-Symbol:** is a Symbol that represents a Storage for Data, a Database and rarely a DataFile.

The “DataBase”-Symbol is used as a DataSource or DataStorage.

The Symbol is shown in the Figure 31.6.

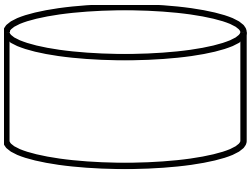


Figure 31.6: The “DataBase”-Symbol

31.4.2 FlowLines

A FlowLine is a Conductor of Data within the FlowChart. Besides of being Conductor, it represents Transition through Activities.

Def. 31.4.2.1*:* **FlowLine:** is a Line that can represent either the Transition (AKA Delegation of Control) from one Activity to another or DataTransfer or ProductTransfer.

A FlowLine is a directed Line and is recommended to have an ArrowEdge to the Direction of ControlDelegation.

There are many Types of FlowLines serving different Aspects with the original FlowLine, an Arrow being the most common of the FlowLines. The “FlowLine”-Symbols are:

- General FlowLine
- Broken FlowLine
- JunctionDot
- CommunicationLink
- “Parallel Operation”-FlowLine

31.4.2.1 General FlowLine

The general FlowLine is an Arrow that acts either as a Conductor for the Data, Intentions and Material or as a Transpiration to another Activity. It is defined as:

Def. 31.4.2.2*:* **“General FlowLine”-Symbol:** is an Arrow that represents Transition from one Activity to another or Conduction of Data, Intention or Material.

The Symbol for the GeneralFlowLine is shown in Figure, 31.7, together with its Dimension.

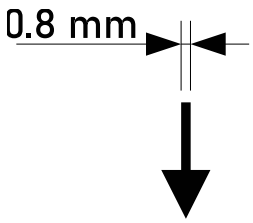


Figure 31.7: The “general FlowLine”-Symbol

31.4.2.2 Broken FlowLine

A Variation of the general FlowLine is the broken FlowLine shown in Figure, 31.8. Such FlowLine denotes an Action in another TimeInstant. It is defined as:

Def. 31.4.2.3*:* **“Broken FlowLine”-Symbol:** is a Symbol that represents the Direction of Action from one Activity to another in a different TimeFrame, consequently it supports Causality in the Future.

Sometimes in a FlowChart is demanded to partition the Regions of the Diagram into TimeFrames as such to denote that something occurs in the Future.



Figure 31.8: The “brocken FlowLine”-Symbol

31.4.2.3 Junction

A Junction is a Location within the FlowChart where FlowLines meet to merge their Transition or to diverge to different Destinations. A Junction is defined as:

Def. 31.4.2.4*:* **Junction (FlowChart):** is a Symbol that represents the Connection of one FlowLine to another FlowLine in Support of one FlowLine or represents the Divergions to different Activities.

The Junction can be used to merge or diverge Transition.

Normally a Junction is not signified, that is, the Lines are do not indicate any Connection. Personal Experience has shown me that is better to signify a Dot in the CrossingPoint of two Lines, of Diameter 1mm, see Figure, 31.9.



Figure 31.9: The JunctionSymbol

31.4.2.4 CommunicationLink

The CommunicationLink is a FlowLine that indicates remote Access in a wireless Fashion. Remote Access is the Capacity of a System to control another System from a Distance, and consequently, the CommunicationLink represents wireless Access through any non conventional Means, such as optical Communication with Laser, Transceivers, SatelliteCommunication etc. Its Definition is:

Def. 31.4.2.5*:* **“CommunicationLink”-Symbol:** is a Symbol that represents (typically wireless) remote Access of Information, associated with Reception, Emission and Use of Bidirectional Link.

The Symbol of CommunicationLink is the Thunder, 31.10 in its either vertical or horizontal Form. A Thunder connects two Activities.

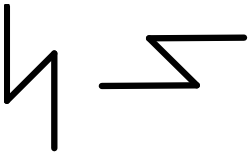


Figure 31.10: The CommunicationLinkSymbol

31.4.2.5 Parallel Operation

The “parallel Operation”-Symbol is the one that is used to show a parallel or concurrent Operation. Though the Terms “parallel” and “concurrent” are used mostly synonymously, in reality this Aspect must be of Concern. Parallel Operation means that two Activities are ordered to occur at the same TimeInstant, but does not imply that the Activities are synchronized. Concurrent Operation means that two Activities are ordered to occur at the same TimeInstant and remained synchronized. However if an Activity is done before another Activity (both they were activated the same TimeInstant), what is the Scenario that follows? This is an Aspect that must be addressed in a Model.

E.g. If two Activities are two Cells of Workers producing Components for a Company and one Cell of Workers finish before the other Cell, then should they wait and be paid? Should they be assigned a new Task?

The “Parallel Operation”-Symbol is not so frequent. It is defined as:

Def. 31.4.2.6*:* **Parallel Operation:** is a Symbol that represents either parallel Operation or Concurrency, where the Data or

Products might be distributed to different Activities or merged to a single Activity.

The Figure on Distribution, 31.11 shows Distribution of FlowLine.

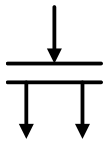


Figure 31.11: The parallel Operation of Distribution

The Figure on Merging, 31.12 shows the Merging of FlowLines into one FlowLine.

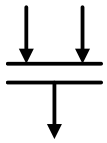


Figure 31.12: The parallel Operation of Merging

31.4.3 Operational Symbols

The operational Symbols denote Activities of various Types, in particular Processors of Data, Materials or Intentions. The operational Symbol is defined as:

Def. 31.4.3.1*:* **Operational Symbol:** is a Symbol that represents an Activity (AKA Operation) that processes Data, Material or Intentions.

The operational Symbols are:

- General Operation
- Predefined Process
- Manual Operation
- DataMerging
- DataExtraction
- Collation
- DataSort

31.4.3.1 "General Operation"-Symbol

A general Operation is an Activity that process Data, Materials or Intentions. It is defined as:

Def. 31.4.3.2*:* **General OperationSymbol AKA Activity AKA Step:** is a Symbol that represents a well defined Operation that can create, modify transfer and erase either Data or Product.

The Symbol for a general Operation is shown in Figure together with its Dimensions, 31.13. Note that its Dimensions are the basic Dimensions for most Quadrilaterals provided.

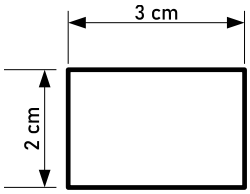


Figure 31.13: The "general Operation"-Symbol

31.4.3.2 "Predefined Process"-Symbol

Sometimes we need to add to a FlowChart an Activity that itself represents a Process that we have somewhere else defined. In this case, the "predefined Process"-Symbol represents such an Activity.

Def. 31.4.3.3*:* **"Predefined Process"-Symbol AKA Steps AKA ProcessCollection AKA Activities:** represents a Collection of either Processes or Programs regarded as a single Entity.

The Symbol of predefined Process is shown in Figure 31.14.

If the Symbol has multiple Entry-, ExitPoints, these are referenced within the Symbol as half-circles arithmetically, and this is shown in Figure 31.15.

It is very unlikely to show multiple Entries and Exits, and if this happens, some

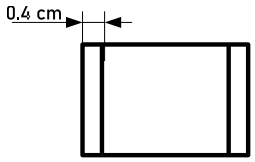


Figure 31.14: The “predefined Process”-Symbol

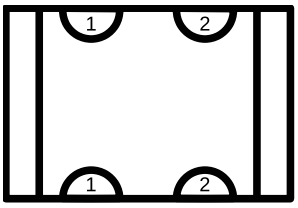


Figure 31.15: The Symbol of predefined Process with Multiple Entries and Exits. Symbol is enlarged to show the Numbers.

Entries and Exits will be chained to “on Page”- and “off Page”-Connectors (more on them soon).

31.4.3.3 Manual Operation

Sometimes, you need to a FlowChart for your Operation to include that the Activity is done manually by a Human [13] . The “manual Operation”-Symbol denotes such an Activity.

Def. 31.4.3.4*:* **“Manual Operation”-Symbol:** is a Symbol that represents an Activity controlled by a Human.

Such Activity is so fast as the HumanSpeed, consequently depending where you are (Switzerland, India) might be of Concern [14] .

The Symbol of manual Operation is shown in Figure, 31.16.

[13] E.g. You employ a Sadist to whip with a Lush the Kids you abuse in your “ClothingManufacturing”-Operation in SE Asia. Please, don’t turn away your Face to Abuse, you love cheap Goods, don’t you?

[14] Sometimes brute Humiliation does the Job ☺.

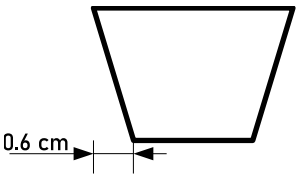


Figure 31.16: The Symbol of manual Operation.

31.4.3.4 DataMerging

Data, Materials or Intentions can be merged to a single Item. The Merging is an Activity itself, but since its Purpose is to create a new Item, the Merging is not considered a Processor itself. In any Case, the “DataMerging”-Symbol is defined as:

Def. 31.4.3.5*:* **“DataMerging”-Symbol:** is a Symbol that represents the Merging of either Data or Products from two or more Sources to one Outcome under a specified Condition or Key.

A special Aspect of Merging is the Condition on which the Merging occurs. Typically a Value or an Annotation is attached to the “DataMerging”-Symbol to denote such a Condition within the FlowChart or at least refer elsewhere with an “off Page”-Connector. The Symbol of “DataMerging”-Process is shown in Figure together with its Dimensions, 31.17.

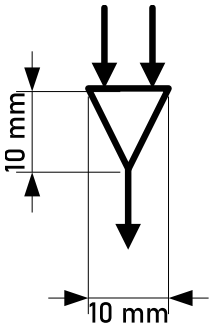


Figure 31.17: The Symbol of DataMerging.

31.4.3.5 "DataExtraction"-Symbol

Sometimes Data, Materials or Intentions can be extracted from a single Item. The Extraction is an Activity itself, but since its Purpose is to separate Items, the Extraction is not considered a Processor itself. In any Case, the "DataExtraction"-Symbol is defined as:

Def. 31.4.3.6*:* **DataExtractionSymbol:** represents the Extraction of either Data or Products from one Source to two or more Outcomes under a specified Condition AKA Key.

This Activity might be a complicated Process that can be broken to minor Activities if needed.

A special Aspect of Extraction is the Condition on which the Extraction occurs. Typically a Value or an Annotation is attached to the "DataExtraction"-Symbol to denote such a Condition within the FlowChart or at least refer elsewhere with an "off Page"-Connector. The Symbol of "DataExtraction"-Process is shown in Figure, 31.18



Figure 31.18: The Symbol of DataExtraction.

31.4.3.6 CollationSymbol

The CollationSymbol is a Hybrid of DataExtraction and DataMerging that merges and extracts Data under a specified Condition; typically a Value or an Annotation is attached to the CollationSymbol to denote such a Condition within the FlowChart or at least refer elsewhere with an "off Page"-Connector. The CollationSymbol is defined as:

Def. 31.4.3.7*:* **CollationSymbol:** is a Symbol that represents Merging with Extracting of either Data or Products from two or more Sources in two or more Outcomes under a Specified Condition AKA Key.

The Collation can be a complicated Activity consequently a Process that can be broken to minor Activities if needed.

The Symbol of CollationProcess is shown in Figure, 31.19.



Figure 31.19: The Symbol of Collation.

31.4.3.7 "DataSort"-Symbol

An important Symbol is the "DataSort"-Symbol where Data, Intentions or Materials are sorted to a new Item under a Condition that should be annotated in near the Symbol.

Def. 31.4.3.8*:* **"DataSort"-Symbol:** is a Symbol that represents the Sorting of Data according to a Condition given as a Key for the Sorting.

The Sorting of Data can be a complicated Activity, consequently a Process that can be broken to minor Activities if needed.

The Condition, AKA Key is a Property that the Data have in common. E.g. In a DataBase the Data can be Rows hav-

ing a Number, a Surname and a Profession. We have three Properties available, the Number, the Surname and the Profession. We can Sort the Data according either to Profession, or Serial Number or Surname. This Sorting uses one or more of these Properties as a Condition for Sorting.

The Symbol of DataSort is shown in Figure, 31.20.



Figure 31.20: The Symbol of DataSort.

31.4.3.8 Manual Intervention

Ideally a Process should be fully automatized with a Person activating the Process at the Start and disactivating the Process at the End. Reality does not conform to this Situation, since a Process has Aspects that need to be controlled. A "manual Intervention"-Symbol denotes the Demand to control an Activity during its Operation. The Symbol is defined as:

Def. 31.4.3.9*:* **"Manual Intervention"-Symbol:** is a Symbol that represents the Intervention by Human at the Time of Processing.

In a ComputerSystem this can be a Person that enters Commands from a Keyboard or clicking Switches on a Console. Either Way, this Symbol models an Input to an Activity and thus it has an Arrow towards the Activity besides the Arrow that shows Transition.

This Symbol has a Duration of a HumanActivity that can span from a few Seconds to whatever Duration the Lovely God has in *His vast and eternal Plans* about the Procrastination that the Operator intends [15] .

Just an Illustration here on HumanActivity. A Manager employed a HumanOperator in India for a ProcessPlant. The HumanOperator was failing to manage manually some Operations that were demanding Attention, since he was most on Time playing Solitaire, his Browser had a History and what a History! Worst, he was the only qualified Person in the Region, and the Politics of the Region had to be obeyed since he was a Son of someone important that controlled the Workers. The Solution to the Problem was made by the SoftwareGuys. The SoftwareGuys managed to install some fake Sensors to the graphical UserInterface of the ProcessPlant that demanded spuriously the Attention of the Operator. Within the Controls remained the Switches for manual Intervention but now the HumanOperator had to click Switches all the Time, even if he didn't know what they served.

The Symbol of manual Intervention is shown in Figure 31.21.



Figure 31.21: The Symbol of manual Intervention.

31.4.3.9 Display

A Display is simple an InformationSource for a Person. It can be a ComputerMonitor, a traffic Light, or even this Apprentice that runs from Office to Office to announce the Firing of Worker. The DisplaySymbol is defined as:

[15] The Emphasis is on the Operetta "Fiddler on the Roof".

Def. 31.4.3.10*:* **DisplaySymbol:** represents any Device that displays or simple reports Information.

This Symbol represents any Machine or Process that can display a piece of Information, whether is a ComputerDisplay, a Telephone, or a Kid informing the Parent that the Toy is broken.

The Symbol of manual Intervention is shown in Figure 31.22, which has its Origins in the "Cathode Ray Tube"-TelevisionDisplays.

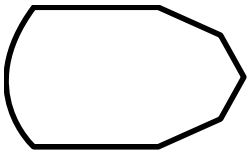


Figure 31.22: The Symbol of Display.

31.4.4 "FlowControl"-Symbols

Controlling the Data- or MaterialFlow of a Process is based on Conditions imposed to an Activity so the Activity will either be taken, adjusted or bypassed. The "FlowControl"-Symbols indicate such Mechanism.

Def. 31.4.4.1*:* **"FlowControl"-Symbol:** is the Symbol that defines the Path of DataFlow with respect to Conditions imposed to the System.

The "FlowControl"-Symbols are:

- DecisionSymbol
- "MultipleDecision"-Symbol

31.4.4.1 DecisionSymbol

A Decision is made when a Question arises such as demands to be resolved under one certain Condition. The DecisionSymbol accepts Data, Materials or Intentions and poses a Question based on a Condition where are two ExitPoints correspondint to a "Yes" or "No". The DecisionSymbol is defined as:

Def. 31.4.4.2*:* **DecisionSymbol AKA BranchSymbol:** is a Symbol that represents a Change in DataFlow under a Condition.

The DecisionSymbol has one EntryPoint and two ExitPoints serving the conditional Validation for the PathSelection. In simple Words, a "yes"- or "no"-Question is tested and according to the Result a particular Path (i.e. Transition) is taken.

The Symbol of Decision is shown in 31.23.

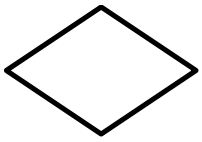


Figure 31.23: The Symbol of Decision.

However be aware that strictly speaking, this denotes a binary Outcome, but in the Past it was also used for many Outcomes; this practice was replaced by the multiple DecisionSymbol that uses the PreparationSymbol. The EntryPoint is on the Peak of Rhombus, the ExitPoints are on the Sides and Bottom of the Rhombus.

31.4.4.2 "Multiple Decision"-Symbol

A "multiple Decision"-Symbol is made when a Question arises such as demands to be resolved under one certain Condition. The DecisionSymbol accepts Data, Materials or Intentions and poses a Question based on a Condition where there are multiple ExitPoints corresponding to the Settings that the Condition implies. The "multiple Decision"-Symbol is defined as:

Def. 31.4.4.3*:* **Multiple DecisionSymbol:** is a Symbol that represents a Change in DataFlow under a Condition where more than two alternative Paths are taken.

The multiple DecisionSymbol has one EntryPoint and more than two ExitPoints serving the conditional Validation for a Set of possible Outcomes. In simple Words, a Question is tested and according to the Result a particular Path (i.e. Transition) is taken.

This Symbol was initially used for the Preparation of ComputingMachines or any other Machine requiring Settings within a Process. Preparation was replaced with a general Operation,as far I know, and eventually this Symbol is now used for showing multiple Paths as ExitPoints. The Symbol is shown in 31.24.

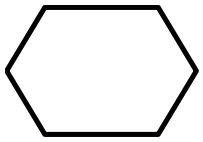


Figure 31.24: The Symbol of multiple Decision.

31.4.5 Auxiliary Symbols

The final SymbolSet is the one of auxiliary Symbols. There are Symbols that Support the Entry and Exit of the FlowChart, whether the FlowChart itself or the Connection of the FlowChart to other FlowCharts elsewhere. Another Symbol, the one of Annotation, belongs to this SymbolSet since it refers to the Entry- or ExitPoint of the "FlowChart"-Reader. The auxiliary Symbols are defined as:

Def. 31.4.5.1*:* **Auxiliary Symbol:** is a Symbol that supports the Metalanguage of the FlowChart, that is, the Environment of the Context that the FlowChart models.

These are:

- TerminalSymbol
- "On-Page"-Connector
- "Off-Page"-Connector
- AnnotationSymbol

31.4.5.1 TerminalSymbol

A TerminalSymbol indicates the Beginning and the End of the Process that the FlowChart models. It is defined as:

Def. 31.4.5.2*:* **TerminalSymbol:** is a Symbol that represents the Beginning or the End of an Activity or Process.

The TerminalSymbol is shown in Figure 31.25. As Figure it contains the Words "Begin", "Start", "End", "Finish". I have even seen it to write: *Mary if you read this please do the Following:* where the Following was a humorous FlowChart for setting Up a Kid's Room. The FlowChart was placed at the front Door of the Room.



Figure 31.25: The Symbol of Terminal.

31.4.5.2 "On-Page"-Connector

FlowCharts can become cluttered when a Process has many Activities and different Paths. To solve this Problem the "on Page"-Connector connects to a FlowLine and diverts the Flow somewhere else in a Page; consequently the "on Page"-Connector contains a Value which points somewhere else. The Connector is defined as:

Def. 31.4.5.3*:* **"On-Page"-Connector:** represents an Entry- or ExitPoint from another Part of the FlowChart within the same Page.

The "On-Page"-Connector always comes in Pairs, one Connector to Exit an Activity and another to Enter an Activity.

The Figure 31.26 shows this Connector.

31.4.5.3 "Off Page"-Connector

The "off Page"-Connector connects to a FlowLine and diverts the Flow somewhere

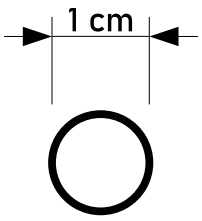


Figure 31.26: The Symbol of “On Page”-Connector.

else outside the current Page; consequently the “off Page”-Connector contains a Value which points somewhere else. The Connector is defined as:

Def. 31.4.5.4*:* **“Off-Page”-Connector:** represents an Entry- or ExitPoint from another Part of the FlowChart concerning different Pages.

The “Off-Page”-Connector always comes in Pairs, one Connector to Exit an Activity and another to Enter an Activity on another Page.

The Figure 31.27 shows this Connector.

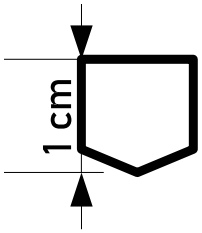


Figure 31.27: The Symbol of “Off Page”-Connector.

31.4.5.4 Annotation

An Annotation is a Connector from the FlowChart to the Reader of the FlowChart. As such it informs the Reader about an Aspect of a Symbol. The Annotation contains an Line that points to a Symbol, as well as a Space to write down Notes about a Symbol. The Annotation is defined as:

Def. 31.4.5.5*:* **AnnotationSymbol:** is a Symbol that represents a short Comment of Reference to a Symbol and is always associated with a Symbol.

The Figure 31.28 shows this Symbol.

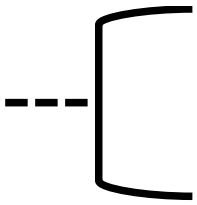


Figure 31.28: The Symbol of Annotation.

31.5 Examples on FlowChart

While the FlowChart was a great Process for deriving the DataProcessing and OperationFlow, the Advancement of new DesignMethodologies as well as the difficulty of the FlowChart to model different Timing-, Resources- and InteractionAspects of Data and Operations, made the FlowChart to become a DesignTool out of Favor. However many Designers learned somewhat the Tool and still use it. The Purpose of the Examples is to show possible Uses of the Tool in various Aspects of Design. However, remember at all Times, that the FlowChart is used to discover Parts of the Design that were not addressed at the first Place.

31.5.1 An Access to multiple DataSources

A Manager requires that a System has processes three Sources of Data. One of the Sources is remote, while one Source, Source “D” determines if the System will operate or not. If The Source “D” is available, then the other Sources “B” and “C” will be accessed for harvesting Data with Source “B” accessed such as it provides its Data based on Date which these will

be Merged with the Data from “C”-Source creating the Set “E”. Only when these Operations are over, only then the Data “E” are merged with Data “D” to form the Set “F” which will be stored in DataStorage F. The Set “F” will be further manipulated to extract the Set “G” which will be stored in DataStorage G. Once the Extraction is Over, then the DataSource D is closed, and the System has finished its Operation. The Manager, though he was himself an Engineer, does not have much Knowledge of the current ModelingMethods and provides Figure 31.29.

Within the System, Figure 31.29, you can identify the various Aspects of this DataProcessing. In particular, the concurrent or parallel Operation of DataRetrieval which raises the Question if the Activities are synchronized or driven by Events. Some “DataManipulation”-Processes have Annotations to identify the generated DataSets, but do not specify any actual Merging Algorithm which raises more Questions. Another Problem is that the Diagram shows two Types of Data: Data to inform the Activation of Activities, and Data generated by Activities. This is the Type of Mix that in the Past was avoided, but today is tolerated since the current Idea of the FlowChart is to identify the Concept of a System. The Implementation of the System as Diagram will be done with more advanced Tools, e.g. UML which will model the static Level, the dynamic Level and the InteractionLevel of the System.su

31.5.2 A Game that makes the People addicted to it

Games such as Sudoku act to provide a passing Solution as the Optimum between Participants. The Participants are the minor Squares of 3 by 3 Numbers, the Major Square 9 by 9 and of course the Player. By challenging the Player to get a Solution that is optimized to the Demands of the Participants (each minor Square must have the Values of 1 to 9, and the same goes for each Row and each Column), the Player gets very quickly addicted to the Game due to the apparent Easiness while struggling to satisfy the Demands of the Participants; this brings Addiction which supports the Adverts of the Game generating Revenue to a Company. The Manager of a Company specializing in InternetGaming provides the FlowChart for such a Game, i.e. the Pattern of the Game to his GameDevelopers, see Figure, 31.30.

The Game does not have a Terminator for Ending. What that it could mean? Back in the 80s there used to be available as Toy “Hand held”-Consoles with “LiquidCrystal”-Display that had a simple Game, e.g. Collect the Fruits. The most cheap of these Consoles had only an “On Off”-Switch that was starting and closing the Game. The Switch was acting also as a “reset”-Switch; there was no Demand for any further Control than start the Game and close the Game [16] . The Game starts when the Kid activates the Switch and directly jumps to the GameActivation. The Kid then observes the GameState, where it Enter some Stimulus by use of ButtonPush, and the Data from this Stimulus are merged with Data from a DataBase called “ParticipantData”. The new Stimulus affects the GameState and if the Goals of the GameState are positive, then a Counter adds Credits (Victory) to the Player; otherwise, the ParticipantData are changed and affect the merged Data. Here however there is a Problem: the Kid enters Stimulus only once? No! In reality these Games were made from very small digital Circuits [17] and the Merging of Data required always the Input from the

[16] Tears in the Eyes of the Kids appeared when the first Consoles came with “On Off”- as well as “reset”-Button!

[17] These Games didn’t have Microprocessors or Microcontrollers but “Mealy”-Machines in TTL (go Figure), later CMOS. These “Mealy”-Machines had delayed Inputs from a MemoryChip (nothing large) and together provided Change in the LCD.

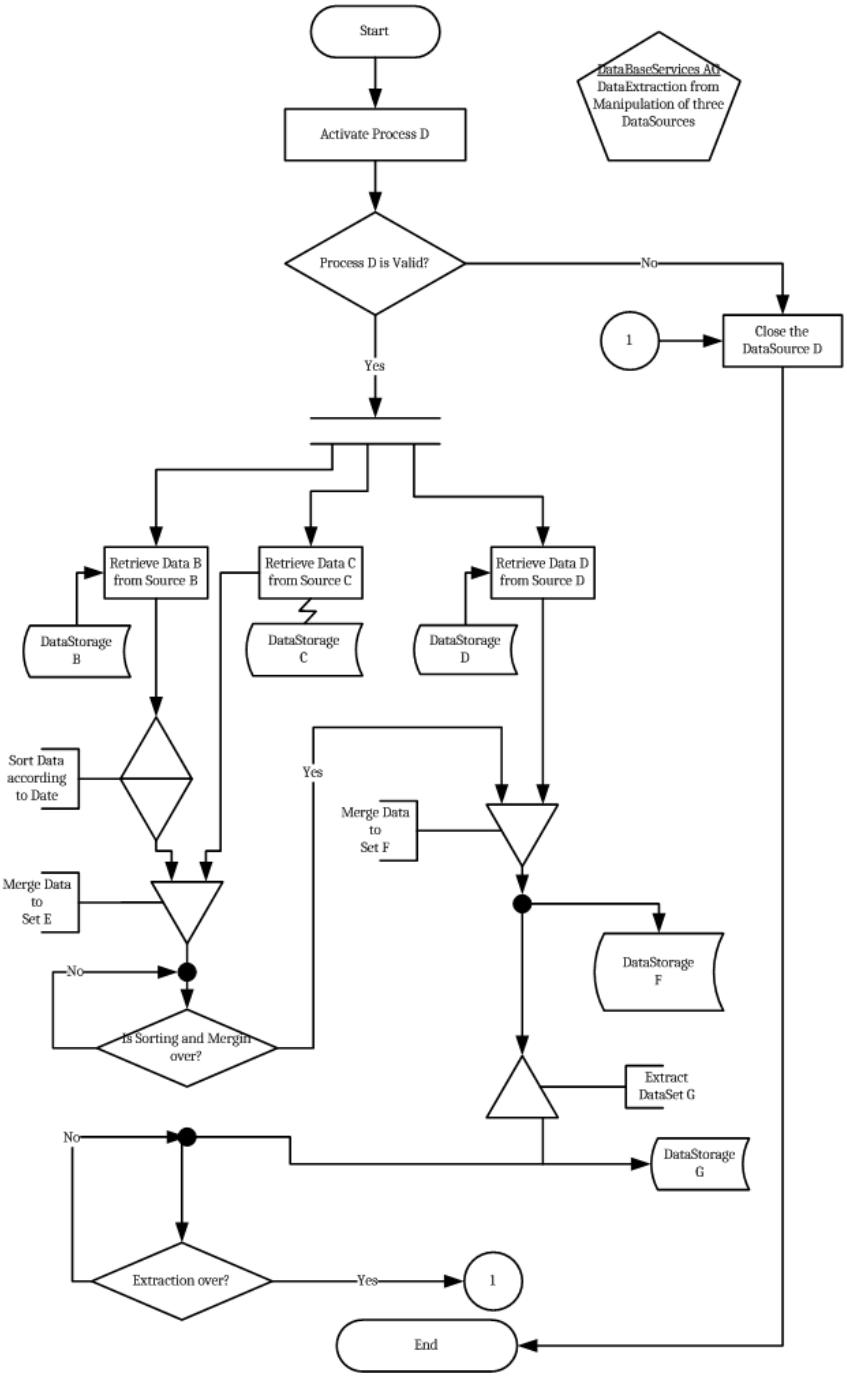


Figure 31.29: A System that describes an Access to multiple DataSources.

Player, i.e. the Player continuously enters Data. The whole Idea here is while the FlowChart does not logically explains the Process in one Part, the Technology behind it, it does! These are the Notation-Problems that can turn good Engineers to

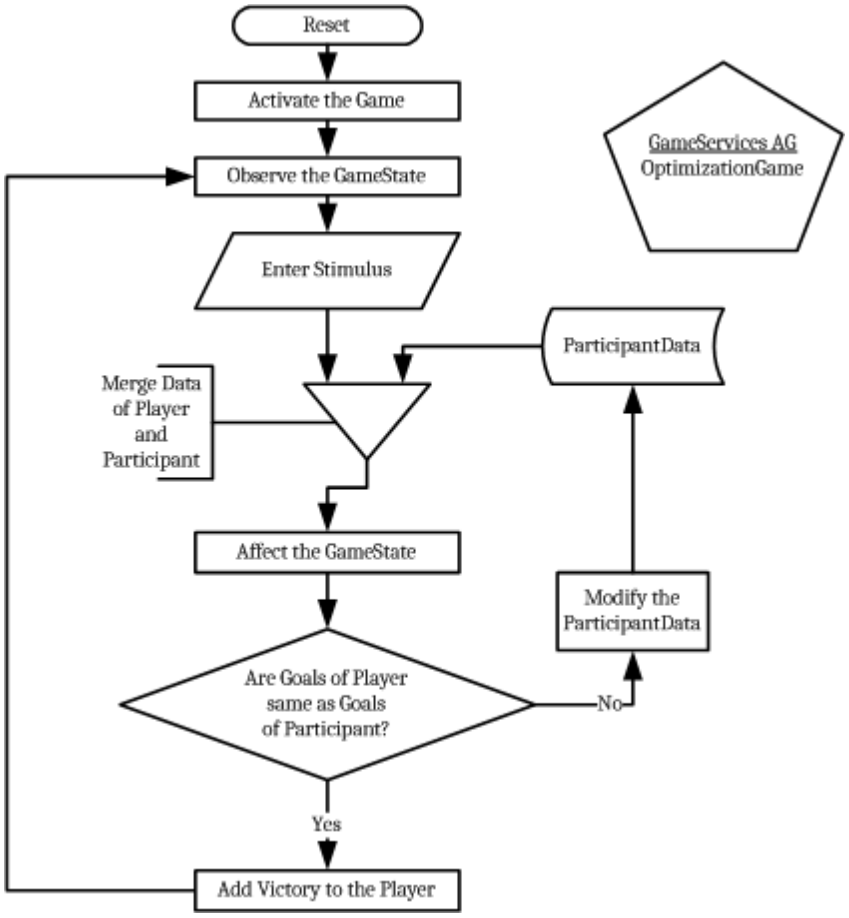


Figure 31.30: The Pattern of a Game of Optimum.

Monsters!

31.6 Bibliography

• [IBM]:IBM. Flowcharting Techniques GC20 8152 1. IBM, New York, USA, 1969.

• [ECMA]: ECMA. Standard ECMA 4: Flow Charts. European Computer Manufacturers Association, Geneva, Switzerland, 1964.

• [Schlager et al]: Schlager et al. How products are Made, Vol 1. Term: Lipstick on some Steps.

Part: Latex

Chapter 32

Latex

32.1 Latex

Latex, (spelled like **Latech**) [1] , is a "TypeSetting"-System intended for the Creation of technical Documentation. A more complete Definition of Latex will be:

Def. 32.1.0.1*:* **Latex (Publishing):** is a standardized "TypeSetting"-System used for the Publication of scientific Texts with Orientation towards mathematical Publishing.

The Term **"TypeSetting"-System** encloses most of the Aspects that deliver to the Customer a aesthetically beautiful Document. In particular Latex defines its own Templates as well as an extensive Library of graphic Capabilities. With Respect to scientific Writing, Latex is **THE TOOL** for the Editing of scientific Text. However most of the People tend to conform to Office SoftwarePrograms, and that's alright if the Documents are small in Size and Capability; for more advanced Documents that require a Multitude of Functions, Latex is the best Solution. Point!

Note that the Language of this Text, was intended to be British English, but the Origin of "Latex"-Commands is USA English, which is the preferred Language of Commands. For Example, the English Word "Colour" is in American English written as "Color" and has the "Latex"-Command **\color**. For this Reason, I decided to keep away the Use of British English in the Orthography, so that you won't mess-up. **Any linguistic Errors within this Text should be attributed to me, the author (Neufelt Christopher) who is not native Speaker of English! In Addition the Author suffers of neurological Disorders of Asperger and ADHD which add to the Problem of Linguistics, as well as remembering Commands and Processes. This Book serves firstly the Author's problematic Memory.**

Questions and Exercises

1. What is Latex?
2. What is the preferred English used in "Latex"-Commands?

32.2 The Course of Latex

The Course provided here employs the "Top to Bottom"-LearningApproach. This Approach starts with an SystemOverview and ends with ComponentOverview. Concerning the ComponentOverview, I try to avoid much Details,

[1] I spell it "Latex", not "Latech" since I find problematic the double Use of a Consonant as "x" and "ch". This "ch"-Use simple defies the Uniqueness of the "x"-Consonant which has the Pronunciations "GZ", "KS", and when at the Beginning of Word as "Z". I don't know what **D. Knuth** had in his Mind when he conceived the Name, and I am not here to judge him.

since Details can be found, but a correct Overview is found only by those that "climbed the Peak" of the Endeavor. I started with the Definition of Latex, and then I proceed to Writing and Printing giving the vital Terms that are used and abused by Amateurs and Professionals alike. Then I give an Overview to the deprecated Technology of TypeWriter, but also to the current Technologies of Fonts and Sets of ComputerCharacters. After this long Introduction, I proceed to describe the DocumentStructure in "Latex", before I describe the DocumentElements that reside in this Structure. Finally I describe some Methods for creating technical Content in Mathematics and Electronics.

The Level of Detail that I enclose this Information is not very deep. This was done with the Intention of producing a standard Interpretation of "Latex" that can be later used for extracting more Details. Once this Interpretation is achieved, then the Reader can study in more Detail the "Latex".

For the People that are involved in LearningDesign, the Pattern of Interpretation that I use is not strictly "Top to Bottom" but rather spiral, with the Top of the "Spring" having the smallest Radius and the Bottom of the "Spring" having the greatest Radius.

32.2.1 Scope of this Document (The one you read right now)

The Scope of **this** Document is to help a Person to learn the most basic Principles of "Latex", from the Perspective of BookEditing. At the End, the Person should be capable of creating a "Latex"-Document and be capable of understanding the "Latex"-Technology.

32.2.1.1 Prerequisites for the Learner

The Learner knows how to use a personal Computer with "Windowing"-GUI and he knows how to use the most simple "ComputerText"-Editor, such as Microsoft Notepad.

32.2.1.2 Requirement for the Learner

The Learner is required to do the Exercises after he understood the current Focus of his Learning which might be a Section or a Chapter. In this Way, he can get a good Idea of the Material provided. The Exercises require often the CodeReuse. That is, you should use **the current creative Practice of copy and paste** [2]

32.3 Writing

We use the Term "Writing" to describe any Process that concerns the Act of imprinting Text on Paper by Use of (typically) a Pencil.

Def. 32.3.0.1*:* **Writing AKA WritingProcess:** is called the Activity of inscribing Symbols on a Surface by Means of a WritingInstrument.

WritingInstruments are the Pen, the Pencil, the PaintBrush, the FeldPen etc. In Sculpture a WritingInstrument can be a Chisel.

A second Description of "Writing" is to describe the Result of the Process of Writing on a Paper. E.g. A Paper contains the Writing(Result) of Jim. This of Course can be misinterpreted as *the Way of Writing* which is unique for every Person and the Term in Use is "Graphical Character".

Def. 32.3.0.2*:* **Writing AKA WritingResult:** is the Result of the WritingPro-

[2] In my Opinion, unfortunately this is very frequent in the World of Arts and Technology, this is why we don't enjoy them any more.

cess and describes the mental Effort of a Person, typically written on a Paper.

Concerning WritingResult, a special one the the "Technical Writing" which concerns the Use of WritingResult to record the scientific and technical mental Effort of someone. As such, technical Writing is very demanding since it has to precise, supported by Evidence and presentable.

Def. 32.3.0.3*:* **Scientific AKA technical Writing:** is the WritingResult that describes the scientific mental Effort of a Person.

Returning to WritingProcess, a Person uses his Hand to write on Paper his Thoughts. This is called "Handwriting".

Def. 32.3.0.4*:* **HandWriting:** Handwriting is the WritingProcess performed by the Hand of the Person.

The HandWriting is different from Person to Person, depending on his Development as a Person. The graphical Character is the Style of Writing a Person uses.

Def. 32.3.0.5*:* **Graphical Character:** is called the individual Style of Writing that a Person performs by Hand, according to his Development.

During different TimePeriods, the People used particular WritingStyles to record their Thoughts. These Styles are called "Hands".

Def. 32.3.0.6*:* **Hand:** is called any WritingStyle used collectively during a historical Period.

E.g. Carolingian Hand, see 32.1, Suetterlin Hand, see 32.2.

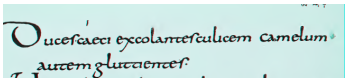


Figure 32.1: Speciment of Carolingian Hand. Source: Johnston, Edward. Writing and Illuminating and Lettering. Pitman, London, Britain, 1932.



Figure 32.2: Alphabet by Sutterling Hand. Source: GS Aktuell 91. September 2004.

The "Hands" gave Rise to various Techniques and how to deploy these Techniques defined with the Term "Penmanship".

Def. 32.3.0.7*:* **Penmanship:** is called the Technique of HandWriting, typically using a Pen, and includes the DeploymentMethods of WritingInstruments as well as the particular "Hand" (Style of Writing) used.

The Culmination of Aesthetics in WritingResults came when the aesthetic Aspect (spatial Rhythm of Characters, harmonic Connection of Characters, Configuration of Characters, Ornaments on Characters, Color of Characters) got integrated with Penmanship. This gave Calligraphy, which is the artistic Penmanship.

Def. 32.3.0.8*:* **Calligraphy:** is called the Art and Technique of Penmanship in Terms of informative Content of aesthetic Value.

In any WritingResult, the Person uses Characters, Numbers and Symbols; all of these are known as "Glyphs".

Def. 32.3.0.9*:* **Glyph:** is called the fundamental Symbol of specific Meaning intended for Writing. It can be a Character, Number, Punctuator, Delimiter or generally a Symbol, however of CharacterSize.

Having written on these Aspects, I note here my Interpretation of the Abolishment of Calligraphy in the "West"-Schools: this

was done in order to reduce the aesthetic Value of the Western Citizens under the Excuse of providing no practical Purpose. Change my Mind. It was replaced by Graffiti that eventually shown the Control of the Areas by Gangs and People of lower aesthetic Content. However, let's not completely accuse the Gangs and self made Idiots for this Tragedy: the Perpetrators for the Abolishment of Calligraphy sit in corporate and government Offices.

As I say, "killing a Flower is the prelude to Concrete".

32.4 Text and Document

The Material that a Person has prepared with the WritingProcess can be described collectively as Text, but is better to be very specific and close any Misinterpretation.

A Datum is a Part of Information, It can be considered as an Object containing a Part of Information and can be tangible as Paper or intangible as a ComputerFile.

Def. 32.4.0.1*:* **Datum, pl. Data (Publishing):** are Objects consisting of InformationParts.

In Publishing, a Datum is delivered with Text.

Text is a Term that encloses two Aspects, the one Aspect is something that is written and the other Aspect is the Content that a Person wrote. Generally the first Aspect is here the most Important, while the second Aspect, known as ReaderContent, will be examined later.

Def. 32.4.0.2*:* **Text (Publishing):** is Information conveyed with Characters in an InformationMedium, such as a Paper or a ComputerFile.

The Text is used in "Latex" for two Purposes: to convey the Content that someone wrote and to convey Codes to a ComputerSoftware that will provide the PublicationProcessing of the Text. In a Text as a Whole, the Data are the Words, Sentences, Paragraphs, Symbols where on their own, do not constitute the Information that the Writer delivers. This Information is provided by isolating from the Text Content intended for the Reader.

Having in Text two Types of Data, we can consider that Information is contextualized Data targeting two different Subjects, the Person and the SoftwareSystem. As Definition, Information in general within "Latex" I regard as the contextualized Data.

Def. 32.4.0.3*:* **Information:** is a structured Collection of contextualized Data

Data on their own are useless without a Container that associates them in a structured Entity. The structured Entity is of course Information. A representative structured Entity of Information in ComputerScience is the ComputerFile. A ComputerFile in "Latex" can contain both Information from an Author as well Information for a SoftwareSystem. By Definition:

Def. 32.4.0.4*:* **ComputerFile (Publishing):** is a nontangible "Information containing"-Entity that exists in an "electronic Memory"-Medium.

A ComputerFile stores Information that can be directly processed by a Computer. The Result of Processing ultimately targets the Person serviced by the Computer, and this Person *might* be a Reader.

While a ComputerFile contains Data for the Reader and the Software, many DataSources are handwritten Texts. A handwritten Text is called a Manuscript.

Def. 32.4.0.5*:* **Manuscript (Publishing):** is a "hand-written"-Text.

A WritingPad or a Paper or a ComputerFile is the Medium that we inscribe the Memory of our mental Effort. This is typically is called a Document.

Def. 32.4.0.6*:* **Document (Publish-**

ing): is the written InformationMaterial which can be a Manuscript or a "human readable"-ComputerFile or a printed Item.

However a Document is more than a Piece of our Memory: Is a well-defined mental Structure that models directly our mental Effort. The Structure of our mental Effort is best described in a"Computer processed"-Document known as "electronic Document". However not all electronic Documents are equal!

An "electronic Text"-Document is a Document written only with Text and resides in a ComputerStorage.

Def. 32.4.0.7*:* **"Electronic Text"-Document AKA plain TextDocument AKA TextDocument (Publishing):** is a ComputerFile containing only Text.

The "Electronic Text"-Document contains Text in HumanLanguage, described with only the allowed electronic Characters, which can be "ASCII" or "Unicode". As every ComputerFile, the "Electronic Text"-Document can be transferred between Computers and can be printed on Paper. It is possible to modify the "Electronic Text"-Document for TextAlignment on ComputerScreen as well as on Paper by use of ControlCharacters for Alignment; indeed that was done in the first Days of ComputerEngineering.

A "TextEditor" is a Software used directly for Editing of Text in a Computer and it even allows the Processing of non-printable Characters. A TextEditor is used for the Creation, Modification and Storing of "Electronic Text"-Documents.

Def. 32.4.0.8*:* **TextEditor (Publishing):** is a SoftwareApplication intended for the Creation, Manipulation and Storing of TextDocuments.

The Term "Storing" refers to the Process of saving a Document, not to the Storage (i.e. the Hardware that stores) of the Document.

Def. 32.4.0.9*:* **Storing AKA Saving (Publishing):** is the Process of Collection and Storing of Data in a StorageMedium.

The WordDocument is a ComputerFile which represents a Document. It contains the Text as well as ProgrammingCode for the overall Description of the Text as a physical Document. The Description provided by the ProgrammingCode concerns printed Media as well as electronic Media such as ComputerScreens.

Def. 32.4.0.10*:* **WordDocument AKA electronic Document AKA enhanced TextFile AKA SoftwareDocument AKA DocumentFile (Publishing):** is a ComputerFile that models and stores a Document.

A SoftwareApplication related to WordDocuments is the WordProcessor.

Def. 32.4.0.11*:* **WordProcessor AKA FormattingProgram (Publishing):** is a SoftwareApplication intended for the Creation, Manipulation and Storing of WordDocuments.

Major Players of Software for WordDocuments are **Microsoft**™ with the Product **Microsoft Word**™ and **The Document Foundation** with the Product **Libre Writer**. For the Microsoft Word™, we typically refer to "Microsoft Word"-Documents as WordDocuments so far as the our Context is clear, i.e. we all work with "Microsoft"-Software.

The Manipulation of a Manuscript is called "Editing"; in ComputerEngineering the Word "Editing" can be used in two different Ways, as Manipulation of the Content or as Manipulation of the Form of the Content. Typically the Term "Formatting" is preferred for describing the Change of the ContentForm. Defining at first "Format" in order to make clear the Distinction between the Terms:

Def. 32.4.0.12*:* **Format (Publishing):** is the spatial Arrangement of a published

Medium.

"Format" can refer according to this Definition:

- The Size of a Document
- The Characteristics of a Template for a Document
- The Appearance of the DocumentElements and their Configuration

Def. 32.4.0.13*:* **Formatting (Publishing):** is called the Process of Changing the Form of a Content.

Def. 32.4.0.14*:* **Editing (Writing):** is the Manipulation of the ReaderContent in Terms of Structure and Meaning.

Def. 32.4.0.15*:* **Editing (Publishing):** is the Manipulation of ReaderContent in Terms of Presentation and concerns the Art and Science of Publication and Printing.

Questions and Exercises

1. What is Datum?
2. What is Text?
3. What is Information?
4. What is ComputerFile?
5. What is Manuscript?
6. What is Document?
7. What is "electronic Text"-Document?
8. What is a TextEditor?
9. What is Storing?
10. What is an WordDocument?
11. What is a WordProcessor?
12. What is Formatting?

32.4.1 The Difference between a SoftwareDocument and a "Latex"-Document

There are many Differences between a SoftwareDocument such as **"Microsoft Word™"**-Document and a **"Latex"-Document**, but the main Difference its their Purpose:

A SoftwareDocument binds with the Ecosystem of BusinessApplications and supports updated and reconfigurable Content that is considered nonfinal for the Operations of the Company, however is supportive of the BusinessProcesses.

The Term "nonfinal", refers to a Document that is continuously updated to suit the Requirements of the Author.

E.g. An electronic Document that updates the MembersList of a Company will continue to update itself: it simple looks at the current MembersList and copies it and then modifies it.

On the other Side, a "Latex"-Document can provide the Functionality and Support of BusinessApplications but its Purpose is to provide a printed Document that will never change, or at least it is not intended to change. The Word "printed" applies to PaperDocument as well as static electronic Document, such as **"Adobe™Acrobat™PDF"-Documents**.

Questions and Exercises

1. What is difference between a SoftwareDocument and a "Latex"-Document?

32.4.2 Size of "Latex"-Typesetting-Technology

The "Latex"-Typesetting is vast, and only very few Options are discussed in this Book. The best way to learn this, is by doing. Issues that you can study on your own are:

1. How to copy Data in "Latex"-Format
2. How to migrate Schematics in Latex
3. How to create various Classes of Formulas
4. How to create various Classes of Diagrams
5. How to create various Classes of Documents

In my Opinion, there are three Levels for "Latex"-Proficiency.

- Level 1: Use of Latex to create Documents (easy Level)
- Level 2: Use of Latex to create advanced Documents and Commands (medium Level)
- Level 3: Use of Latex and Tex for Documents and Programming (hard Level)

32.5 Course of Study for Latex

Latex is large, and becomes larger Year by Year. You can start from Beginning to End each Chapter. The Chapters concerning TypeWriter, Fonts and ASCII can be skipped if the Time presses. I have include these Chapters as a Complement of PublishingTechnology and can explain Things that surprisingly are not much taught. The actual TypeSetting that concerns your Projects with Latex, starts with the Chapter "Practical DocumentStructure" so you don't have to learn Commands but only the Concepts of the DocumentPreparation. Unfortunately most of the Books on Latex very mixed Information on actual administrative Tasks and historical Terms, which I have to clarify, so that at the End of the Day, you can safely sit on your Chair without the common Pain occurring deep in the Colon after the Encounter with problematic Information. The Information I provide is easy to Learn, whether you are working as a Medical Butcher of a Middle East Embassy or you are visiting a GayBar.

Chapter 33

The TypeWriter

Narrative

This Chapter is about the (mechanical) TypeWriter. I had to write this, for the Understanding of some "Key"-Concepts concerning the Space between Words, the CharacterSet and ControlCommands. It is easy to comprehend with a decent IQ of 70 Points ("Forrest Gump"-Level or SenatorLevel).

This Chapter can also be skipped if the Time presses.

33.1 Description of TypeWriter

The (mechanical) TypeWriter is a mechanical Device that allows the characterwise TextPrinting one Character at the time. As a Machine is relatively of small Size, around 25cm times 25cm (10" times 10" Inches in the Colonies) [1] and is relatively portable. See Figure 33.1.

33.2 Parts of Typewriter

The TypeWriter mainly consists of two Parts, the **PaperCarriage** and the **KeyBoard**. The PaperCarriage holds the Paper. The KeyBoard performs the CharacterEntry on Paper. See Figure 33.2.

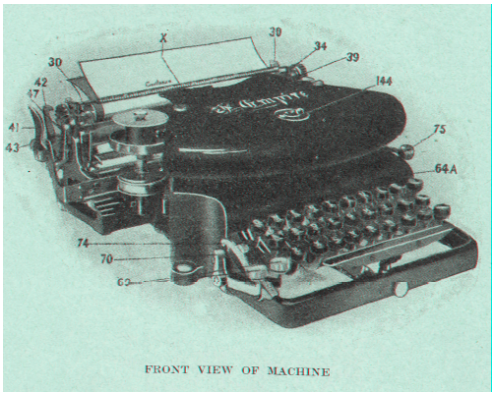


Figure 33.1: A TypeWriter. Illustration from [Nicholson].

The Keyboard consists roughly of three Parts, the **InkBand**, the **KeysCollection** and the **"Hammers"**. The Hammer hits the Paper and imprints a Character. The InkBand appears between Hammer and Paper upon their Contact and immerses the **HammerHead** to Ink so that the Paper obtains the Character that the HammerHead contains. Buttons called "**Keys**" connect with the Hammers in a Mechanism of a Lever, i.e. by hitting a "Key", the Hammer moves to hit the Paper.

The PaperCarriage performs the PaperMotion (before or after the CharacterPrinting) so that Space or Space for Char-

[1] It can also be used as a fireless Weapon if you use against the Head of a Person; it is relatively splattery in its Effect, this is why the traditional NeckBreaking is advised.

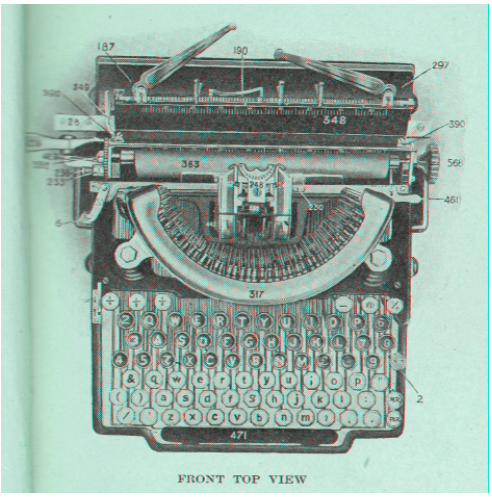


Figure 33.2: A TypeWriter from the Top. Illustration from [Nicholson].

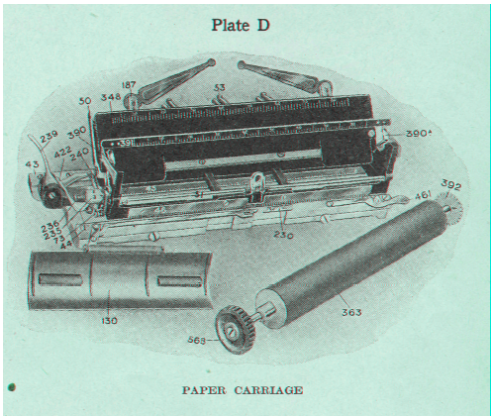


Figure 33.3: The PaperCarriage of a TypeWriter. Illustration from [Nicholson]

acterPrinting can be created. This is done by moving (i.e. Carrying) the whole Mechanism with the Paper, thus this is the Origin of the Term "PaperCarriage". The PaperCarriage contains two Parts, the **"PaperCylinder"** where the Paper wraps and the **"CarriageReturn"**-LeverArm, which is a Stab that allows the Cylinder to rotate with the Purpose of displacing the Paper vertically: the latter allows the Creation of Space between TextLines. Space between Words (AKA "Interword"-Space) is done by pressing the "Space"-Key where upon pressing, the Cylinder moves to the Left and the Focus of the Hammers is the next Space at the right of the Paper. Consequently, the PaperCarriage provide two Directions of Motion for the Paper, a horizontal Direction via the "Space"-Key and a vertical Direction via the "CarriageReturn"-LeverArm. The PaperCarriage is shown in the 33.3. The Use of "CarriageReturn"-LeverArm is shown in the Figure 33.4.

The Hammer has two Parts, the **"KeyConnector"** (where it connects a Key to a LeverMechanism) and the "HammerHead", which is the Part that hits the Pa-

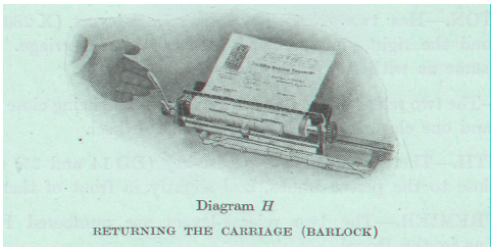


Figure 33.4: The Use of "CarriageReturn"-LeverArm to forward the Paper on the TextLine below the current Focus of the TypeWriter. Illustration from [Nicholson]. By the Way, this is the traditional Way to slap someone ☺.

per. The HammerHead contains a Piece of Metal which has Extrusions resembling the (mirrored) Image of a printed Character; this Piece of Metal is called **"Type"**.

33.3 Operation of TypeWriter

The PaperCarriage wraps on its Cylinder the Paper. By pressing a Key, Characters or Space can be created on Paper. When a TextLine is completed, the Person can use the "CarriageReturn"-LeverArm for forwarding the Printing on the TextLine below the current Focus of the HammerHeads.

33.4 Learning to type

Learning to type (i.e. to use the TypeWriter) used to be Course, where gradually you learned by typing the Use of all Keys as well as the Settings for the TypeWriter. The Advent of Computers made the Typing as somewhat problematic since the KeyBoard was used as a Console for the Control of the Computer, i.e. more Keys where introduced to support the ComputerOperation and consequently the KeyBoard did not serviced well the ComputerUser.

There are still Courses about Typing, and is suggested to visit one (I did). People with neurodivergent can be extremely good Typists or less than average, BrainDamage can also help.

In my Opinion, a typical Course should include the following LearningTasks which my Experience indicated me are the most important:

- **TextTyping**: in TextTyping, you learn to write Text with the KeyBoard on a DocumentSoftware such as NotePad™.
- **ComputerControl via Console** (i.e. KeyBoard): in ComputerControl via Console, you learn to use the Computer for Administration of Tasks by Use of only TextCommands given by PowerShell™or CommandShell™.
- **Integration of TextTyping and ComputerControl**: in this Part, the Unification of TextTyping (with a SoftwareApplication such as NotePad) and the ComputerControl is done so that the Transition between creative Typing and ComputerAdministration runs without any Hesitation and Delay by the User.
- **Integration of ComputerControl and WordProcessor**: in this Part, the ComputerAdministration and the EditingAbilities of a WordProcessor (such as Microsoft™Word™) are unified so that the User can perform creative Typing, TextEditing and ComputerAdministration without any Hesitation and Delay.
- **Learning of major Commands of a "Latex"-Software**: Here this is a MemorizingProcess where common Commands and Macros (i.e. Commands that you have created) are learned together with KeyShortcuts for complicated Commands. Such Learning can give large Dividents in the long Term.

In the Bibliography I suggest the Book on Typing by [Nelson], though in some Parts is rather hardcore. An Estimation for learning it would be around a Month. In the Past, 160 til 200 Words per Minute were achievable by professional Secretaries.

33.5 Bibliography

- `[Nelson]`: Nelson, Julius. Typing for accuracy. The H.M. Rowe Company, Communication Services, Baltimore, USA, 1977.

- `[Nicholson]`: Nicholson, R.T. Mechanical Devices of the Typewriter. Sir Issac Pitman and Sons, London, UK, 1904 (?).

Chapter 34

Overview of EditingTerms

34.1 A Metaphor for Latex

I will use now the Metaphor of a Visitor (the Learner in his rare, sober, State) visiting a PublishingCompany. Here the Visitor learns about the **Steps to Publishing**, the **Occupations** associated with Publishing and the **Structure of the Products** as well as the **Tools** to produce them. He might even spend Time flirting the Secretary before she calls Security to throw him out.

During the Visit, the Visitor will have Tasks like:

1. **Definitions of Terms**: The Visitor informs himself about the Terms of his Study.

2. **Definitions of PublishingOccupations**: Here the Visitor arrives in a Building where People work in Publishing. The Visitor should become acquainted with the Situation that in the digital Area he is the Author, Publisher and Secretary [1] . Here he learns what these Professions are and thus what Roles he must assume.

3. **DocumentStructure and Software**: Here the Visitor get in Contact with the DocumentStructure and the PublishingSoftware.

[1] not a sexy one

34.1.1 Some Definitions of Terms in PublishingBusiness

The following Terms appear by **Order of (relative) Interconnection** and are very frequently in IndustryUse, in the Synonym- or presented Form. These are the Verb "to edit" and the Noun "Aesthetics".

"To edit" means to create or alter the Content of a Document.

Def. 34.1.1.1*:* **to edit (Verb), (Publishing):** is to change the Content of an InformationMedium (such a WritingPaper, FilmSequence, Video, digital ComputerFile) by affecting the Data and/or their Appearance.

Aesthetics provide a Layer of Beauty above the FunctionalityLayer of a Product; this is known as **aesthetic Value** and is a Factor that determines the Success of the Product. The Term "Rhythm" refers to a repetitive or recursive Aspect of the Design itself. The Term "Harmony" refers to the Concordance of each DesignAspect itself. The Term "Content" refers to the Functionality supported by the Product. In Music the Aesthetics employ Rhythm, Harmony and Melody as defined in MusicTerms. In PaintingArt, Aesthetics employ Rhythm, Harmony and Color as defined in PaintingArt. In Publishing, Aesthetics employ the three Terms in various

Ways that create a beautiful Document [2]

Def. 34.1.1.2*:* **Aesthetics (Publishing):** the Art and Science of Collaboration of the Principles of Rhythm, Harmony and Content in complete Unity.

The following Terms are used and abused in Publishing, sometimes even by the Author himself(!): Chart, Diagram, Drawing, Figure, Graph, Graphic, Illustration, Image, Ornament, Picture, Plot, Sketch.

Def. 34.1.1.3*:* **Chart:** is a structured Representation of Data based on a visualization Paradigm.

E.g. the "Pie"-Chart describes the Areas of various Type of Data that represent a Whole.

Def. 34.1.1.4*:* **Diagram (Publishing):** is a visual Description of associated Parts.

E.g. A Diagram of an electric Circuit.

Def. 34.1.1.5*:* **Drawing (Publishing):** is a Depiction generated by an Artist.

E.g. The Drawing of a Castle.

Def. 34.1.1.6*:* **Figure (Publishing):** is anything printed inside a Document.

E.g. In Figure 13 we see the Diagram of a House, Figure 14 shows a Picture of a Person, Figure 15 is a Plot of Data.

Def. 34.1.1.7*:* **Graph (Publishing):** is a visual Correspondence between Data.

E.g. The Graph of X-Data versus Y-Data.

Remark 34.1.1.1. A Graph sometimes is a Synonym to Plot

Def. 34.1.1.8*:* **Graphic (Publishing):** is an visual Artifact or an Ornament.

E.g. The Graphic above the Page is where the Paper will be cut.

An Illustration is a roughly said a Picture.

Def. 34.1.1.9*:* **Illustration (Publishing):** is called the graphical Depiction of an informative Content in Terms of realistic and aesthetic Value.

E.g. the Depiction of a Person or a Depiction of an architectural Item is an Illustration.

Remark 34.1.1.2. An Illustration can sometimes refer to a Picture, a Diagram or a Drawing.

Def. 34.1.1.10*:* **Image AKA Picture (Publishing):** is a Depiction generated by a Camera and is based on the Imprint on of an EventView in a Medium.

Def. 34.1.1.11*:* **Ornament (Publishing):** is an aesthetically pleasant visual Artifact that is used either as a Marker or as a Separator to classical BookPrinting.

Def. 34.1.1.12*:* **Painting (Publishing):** is a Depiction generated by an Artist and it uses brushes and ColorPaints to describe the visual Artifacts.

Remark 34.1.1.3. A Painting is described in Publishing as a Picture, since is copied photographically. This does not usual applied to Drawings and Sketches which might be described as Figures.

Def. 34.1.1.13*:* **Plot (Publishing):** is a mathematical Tool to display scientific Data, typically based on a coordinated System.

Def. 34.1.1.14*:* **Sketch (Publishing):** is an incomplete Depiction generated by an Artist.

[2] If you want to kill a Civilization, you start from Aesthetics. Why you think we are bombarded with Ugliness daily?

Sometimes the printed Media have Titles that are uniquely written. These Titles are made by a Process called "Lettering".

Def. 34.1.1.15*:* **Lettering (Publishing):** is called the Activity, Result or Art of handdrawn Letters (Characters) and serves the Purpose of Illustration.

E.g. the Title of a Magazine can be made in particular Lettering so that adds an aesthetic Value and consequently Identity to the Magazine. ***Add picture of a retro magazine.***

In traditional Printing, a Person, the TypeSetter, was reading the Text and placing the PrintingSeals (i.e. The "Types") into a Form, that then was covered in Inc and finally was pressed on Paper [3] . This Term does not concern "Latex", but it is very frequently appearing on various Tasks relating to "Latex".

Def. 34.1.1.16*:* **TypeSetting (Publishing):** is the PlacementProcess of Types on a Surface that will imprint the Text on Paper.

Documents are Partitioned in their Content so that the Reader can attain a LearningStructure of his Reading. The Term "Section" is used collectively to describe the Parts of the Document. E.g. A Section of the Document is a Chapter, a Paragraph, a Part etc. However, the Term has an additional Meaning in Publishing, that is, Section is also the specific Division of a Chapter.

Def. 34.1.1.17*:* **DocumentSection (Publishing):** is the DocumentPart according to the Structure intended for the Reader.

The Process of Partitioning the Document to Sections is called "Sectioning".

Def. 34.1.1.18*:* **DocumentSectioning (Publishing):** is the Process of dividing the Document into Sections.

During the Creation of a Document the Author will divide the available Material into functionally similar Groups and then he will arrange the Groups according to a Hierarchy. The EffortMaterial contains Papers, Tables, Illustrations and References among others. In our Days it can contain nontangible InformationItems such as ComputerFiles. I prefer the Term "EffortMaterial", since it does not constitute Part of other Processes and consequently is Independent in Meaning.

Def. 34.1.1.19*:* **EffortMaterial AKA Effort, Project, Work, Research AKA Deliverable (Publishing):** is the Sum of Text and Data of a Material provided by an Individual.

The ReaderContent contains a logical Structure (e.g. Chapters, Appendices etc) as well as Information intended for the Reader (e.g. PageNumbers, Colors etc). Obviously it encompasses the EffortMaterial as well the Structure that the Author attempts to deliver.

Def. 34.1.1.20*:* **ReaderContent (Publishing):** this is the Material intended for the Reader and is produced by an Author.

A Page is just Paper or a ComputerScreen where Information is displayed or delivered.

Def. 34.1.1.21*:* **Page (Publishing):** is a Surface where Symbols deliver Information. It can be i. Paper ii. an electronic Screen showing a Page with Data.

The PageLayout is the Process of spatial Arrangement of Text and Illustrations in a Page.

Def. 34.1.1.22*:* **PageLayout (Publishing):** is the spatial Arrangement of Objects in a Page.

Questions and Exercises

[3] Such the Term "Press" for the Profession of Journalists.

1. What means “to edit” in the Context of Document?
2. What is Aesthetics?
3. Define Harmony, Rhythm and Content in Aesthetics.
4. What is Illustration?
5. What is Lettering?
6. What is a Section collectively speaking?
7. What is Document-Sectioning?
8. What is Effort-Material?
9. What is Reader-Content and what contains?
10. What is Page?
11. What is Page-Layout?

34.1.2 Some Definitions of Terms in “Latex”-DocumentPreparation

DocumentPreparation is a a Process where the DocumentStructure is laid. The DocumentPreparation is done automatically in WordProcessors by use of **Templates** which are ConfigurationFiles that affects most of aesthetical and functional Aspects of the Document.

Def. 34.1.2.1*:* **DocumentPreparation (Publishing):** is a stepped Process of creating a Structure that will accommodate a Document.

The “Latex”-DocumentPreparation owns many ProgrammingTerms derived from SoftwareSystems. In Order to avoid Misconceptions, the following Terms are defined:

Def. 34.1.2.2*:* **“Latex”-Editor (Publishing):** is a Person that applies “Latex”-Programming in an electronically available EffortMaterial.

If you are reading this Document for the Editing of EffortMaterial in “Latex”, then you have the Role of the “Latex”-Editor.

Def. 34.1.2.3*:* **“Latex”-Editing (Publishing):** is the EditingProcess of a ComputerFile using the “Latex”-Commands.

Def. 34.1.2.4*:* **“Latex”-Software AKA “Latex”-System (Publishing):** is a Family of SoftwareApplications that produces a “Production ready”-Document

Def. 34.1.2.5*:* **SourceFile (Publishing):** is the ComputerFile that the “Latex”-Editor created from the Effort-Material and is the InputFile to the “Latex”-Software.

Def. 34.1.2.6*:* **DestinationFile (Publishing):** is the ComputerFile that the “Latex”-Software created after processing the SourceFile.

The DestinationFile can be used by PrintingMachines or can even distributed digitally in form of a PDF-File.

The FileFormats for SourceFiles and DestinationFiles are different concerning a Chain of Processes within the “Latex”-Software. However, the Input-Files from the “Latex”-Editor are typically “Latex”-Files AKA “Tex”-Files which are TextFiles.

Def. 34.1.2.7*:* **“Tex”-File (Publishing):** is a ComputerFile with FileExtension **“tex”** and contains “Human readable”-Information which is also understandable by the “Latex”-ProgrammingSystem. Thus, the Tex-File contains the Information for the Reader and the Commands for the TypeSetting.

The Tex-File is the SourceFile for the “Latex”-Software.

Def. 34.1.2.8*:* **“ComputerFile”-Compilation AKA Compilation (Publishing):** is the automatic Processing of one or more ComputerFiles by a

SoftwareApplication.

When someone programs SoftwareApplications, he writes a SourceFile in his ProgrammingLanguage and then compiles the SourceFile into a DestinationFile that can be executed by the User of the ComputerProgram [4] .

Def. 34.1.2.9*:* **Invocation AKA Call (Publishing):** is named the Request to use a Resource of a ComputerProgram.

During the Activation of a ComputerProgram, the User can ask the ComputerProgram for a particular Resource such as Storing the Document. In this Case, the ComputerProgram will *invoke* (AKA *call*) this Resource. The InvocationMechanism is provided by the Computer while the ComputerProgram simple activates this Mechanism [5]

Def. 34.1.2.10*:* **"Latex"-Compilation (Publishing):** is the Compilation of a Tex-Document for creating a printable File.

Concerning Latex, once we have our EffortMaterial in electronic Form, we need to perform the Tasks of adding LayoutCommands and then feed the SoftwareApplication of Latex to carry out the actual Layout. Consequently, the process of Integrating the Material into an actual Deliverable (the DestinationFile), is called "Latex"-Compilation. If the "Latex"-Compilation is not successful, CompilationErrors will appear in the "Latex"-Software. In this case you should correct these Errors. A successful Compilation should be considered the one that does not even have Warnings: *remember that many Warnings are one or more Errors in the Making!* [6]

[4] Actually the whole FilesChain entered and produced is here **very** simplified. In real ProgrammingSystems there can be a Chain of many ComputerFiles.

[5] The whole InvocationConcept has many Names within the Hardware, OperatingSystem and SoftwareApplication technologies. In addition is pretty complicated. I keep it very simple otherwise you will not sleep at night.

[6] Will you Fly an Aircraft that issues Warnings of its Systems during Flight? I do. But then again I am suicidal.

Def. 34.1.2.11*:* **LogFile (Publishing):** is a ComputerFile containing the useful Information that a Process exhibited during its Activation. In Latex a LogFile records the Errors, the Warnings and the Successes if any.

Questions and Exercises

1. What is Document-Preparation?
2. Who is the "Latex"-Editor?
3. What is "Latex"-Editing?
4. What is "Latex"-Software?
5. What is a Source-File?
6. What is Destination-File?
7. What is Tex-File?
8. What is "Latex"-Compilation?
9. What is a Log-File?

34.1.3 Some Definitions of PublishingOccupations

In the digital PublishingEra, the Author of scientific Documents must to acquire PublishingRoles that previously were the Responsibilities of PublishingProfessionals [7] . The whole PublishingEndeavor consists of a DocumentRequirement for a Reader (the final Product) and a Process that takes a Manuscript and delivers a Document to the Reader (the Process that produces the Product). Take Notice that *this Description is very simplified.*

The Requirement consists of an Author producing a Document for a Reader. This

[7] Now I was thinking that an "only Fans"-Role is also an Option for unemployed PublishingPersonnel. Great Idea Chris!

Requirement encloses the PublishingProcess that will be undertaken by an Organization (Publisher or Printer AKA PrintingService).

The Publishing Process consists of the **Author** providing the Publisher with a Manuscript. The **Typist** will process the Manuscript and forward the Document to the Editor, which together with the **graphic Designer**, **Typesetter** and **Typographer** (among others) will produce the EndDocument that will appear in the Hands of the Reader.

The following Terms are frequently appear in this Text and should be defined as Part fo the PublishingChain:

Def. 34.1.3.1*:* **Author (Publishing):** is the Person that composed the Document.

We assume that a Manuscript from the Author is available.

Def. 34.1.3.2*:* **Typist (Publishing):** is the Person that copies the Manuscript into a Document.

Currently the Manuscript is typed by the Author [8]

Def. 34.1.3.3*:* **Publisher (Publishing):** is the Person that produces and distributes ("publishes") the Document.

Def. 34.1.3.4*:* **Editor (Publishing):** is the Person that arranges, modifies, and improves the Readability of the Document.

The term "Editor" is actually very abused Term and should be considered on Context: "Editor" AKA "ComputerEditor" is frequently the ComputerSoftware used for digital Publishing, while "Editor" can refer to the Person who edits the Document or even the Publisher. Some common Sense and figuring out the Roles of each Person is here a *magical Virtue* [9]

Def. 34.1.3.5*:* **Graphic Designer AKA Graphist (Publishing):** is the Person that provides the Diagram in the Document.

In our days this Role is delegated to typically the Author of a technical Document.

Def. 34.1.3.6*:* **TypeSetter (Publishing):** is the Person that arranges the PrintingSettings.

The "formal Appearance" refers to the "End"-Result which is the Work of Editor. It includes, Fonts, ParagraphForm, Colors, Illustrations and Tables as well as the Rules (i.e. Laws) about them among other Tasks.

The Process of TextPreparation so that the Result is ready for Printing, is called as Verb "typeset". It is defined as:

Def. 34.1.3.7*:* **to typeset (electronic Documentation and Printing) (verb):** to prepare the Text for its formal Appearance and Printing.

Traditionally, the Person that performs the TypeSetting is the Typographer.

Def. 34.1.3.8*:* **Typographer:** is the Person that prints the Document.

Typographer and TypeSetter can refer to the same Person in PrintingIndustry. The original Term is "Printer" [10]

Def. 34.1.3.9*:* **Reader (Publishing):** is the Person that reads the finished Document.

The Reader is the "End"-Customer of the Chain of Writing and is not a WritingOccupation. The whole Process can be described in the following Figure, see 34.1:

[8] Consequently we can remove the Typist from this heartless, futile World☺.

[9] It can even save the last Hair remaining on the Sides of your Head from falling. By the Way how did you deal with your HairLoss?

[10] A interesting Information about this Profession, is that, until today (2023), the Typographer (and the Publisher) are Professions closely monitored by the SecurityServices for any Activities that can impose Danger to the State. No this is not Conspiracy, its the true State of Affairs, regulated by the State. *Every State.*

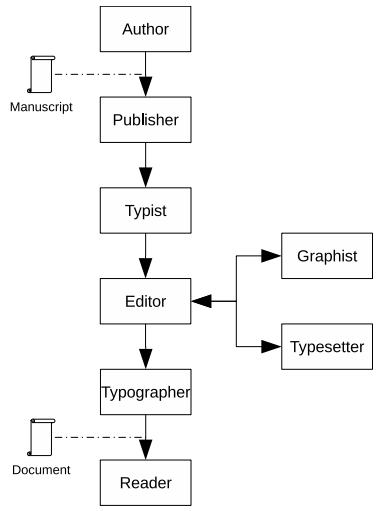


Figure 34.1: The PublishingProcess

Questions and Exercises

1. Who is the Author?
2. Who is the Publisher?
3. Who is the Editor?
4. Who is the graphic Designer?
5. Who is the Typesetter?
6. Who is the Printer?
7. Who is the Reader?

34.2 The two Structures of a Document and the Software-Text-Editors

A printed Document has two Structures, the first is the **ContentStructure**, that is what the Author has in his sick Mind to efficiently convey Information to his Reader and the second is the **logical Structure** concerning the TypeSetting of the Document itself. WordProcessors are divided into two Families of SoftwareApplications concerning the ContentStructure:

Def. 34.2.0.1*:* **WYSIWYG-Editors, AKA "What You See Is What You Get"-Editors (Publishing):** are WordProcessors that represent the Document as the Author would like to have it physically.

Obviously such WordProcessors hide the actual logical Structure of the Document. In addition, WYSIWYG-Editors employ typically **PublishingTemplates**, such as ones for Articles and Books in order to conform to the TypeSetting and logical Structure of a DocumentType.

Def. 34.2.0.2*:* **ScriptEditors AKA "TypeSetting"-Systems:** are WordProcessors that Text can be written together with Commands to create TypeSetting and DocumentLayout.

In this case the WordProcessors reveal all the actual logical Structure of the Document as well as the ContentStructure for the Reader.

There are some **Pro and Contra** for both of WordProcessors: the WYSIWYG-Editors provide the Author with the Capability of quickly creating a Document. Unfortunately, *large Documents quickly diverge from the TemplateStructure*, usually with **ugly** Results. In Addition, the Author will delay the Production in Order to tune the Document to his perverse Demands, and he will be many Times not focused due to the use of Typing instead of Writing [11] .

The ScriptEditors reveal all the Document to the Author but eventually can delay the Author's Creativity.

Latex belongs to the ScriptEditors and tries to release the Author from the Is-

[11] this is actually a biological Aspect of Memory: the Act of Writing with a Pencil, exposes the Brain´s executive Functions (frontal Lobes) to it's ProcessingFunctions (back Lobes) and creates Focus and Memory; that is why the LogBook separates the Scientist from the Amateur. The Amateur can be a Scientist, but such Behavior classifies him as Amateur: Idiot might be a better Term.

sues of Template, DocumentStructure and TypeSetting. **However Latex is a rather hard Methodology to learn. This is a warning: my Condolences.**

Note that **Tex** is a "TypeSetting"-System. Latex is a **"DocumentPreparation"-System** based on **Tex** (for the "TypeSetting"-Aspect) and **Scribe** (for the declarative "DocumentDescription"-Aspect).

Questions and Exercises

1. What stands WYSIWYG?
2. What are WYSIWYG-Editors?
3. What WYSIWYG-Editors employ to create a Document?
4. What are ScriptEditors?

34.2.1 Software for WYSIWYG-Editing

Here the Situation is already known by most Users of a PersonalComputer. The following ComputerApplications are typical of WYSIWYG-Editing:

1. Microsoft Word™
2. Libre Writer

34.2.2 Software for "Latex"-TypeSetting

Here I must make some further Explanations for Tex-Editors and Tex.

Def. 34.2.2.1*:* **Tex (Publishing):** is a TypeSetting-System AKA Engine, developed by the **Demigod Donald Knuth** [12] .

[12] May His Name **recurse** to the Centuries in Infinite Loops

When someone uses Latex-Editing, he uses a hierarchical Form of Tex [13] .

Def. 34.2.2.2*:* **"Tex"-Distribution (Latex):** is a Collection of "Tex"-Programs and Scripts in Form of a SoftwareProgram.

Thus, a Tex-Distribution contains a Tex-Engine [14] .

Def. 34.2.2.3*:* **Tex-Editor (Latex):** is a SoftwareProgram that connects the Tex-Distribution to a "ComputerApplication"-Interface with the Author.
[15]

Def. 34.2.2.4*:* **Latex (Definition concerning Tex) (Latex):** Is a Format of Tex, developed by **Leslie Lamport** in order to provide rapid development of Tex-TypeSetting.
[16]

Def. 34.2.2.5*:* **"Tex"-Packages AKA Packages (Latex):** are Programs and Scripts to be added to the Tex-Engine in order to provide Access and Administration to Objects and Structures. For Example, Fonts, Tables, Diagrams, Converters etc.

Most of the Tex-Users use the **CTAN** as *THE* Source for their Latex-Projects.

Some InternetLinks are now due:

1. http://www.tug.org/texlive This is a free Distribution of latex.
2. http://www.texstudio.org/ The Program TexStudio that connects Latex to an Editor.
3. http://www.ctan.org The Comprehensive Tex Archive Network.

[13] Hierarchical since it uses Programming-Macros to model the complex Structure of Tex.

[14] I use TexLive.

[15] I use TeXStudio.

[16] **Mr Lamport** is a well known Figure in the "ComputerProgramming"-Community. His Godhood-Status is **Hero**. Please offer him a Hug and some Food if you meet Him. Have him in your Prayers. Sacrifice for Him.

4. http://www.texample.net/ Various Examples of TikZ, a graphics Library.

Questions and Exercises

1. What is Tex?
2. What is Tex-Distribution?
3. What is Tex-Editor?
4. What is Latex?
5. What are “Tex”-Packages?

34.3 The Concept behind Latex

There are some Ideas[17] behind Latex and we should pay Attention:

- Text should be freely written.
- “Latex”-Packages should provide **“TypeSetting”-Support** for digital PublishingSystems.
- “Latex”-Commands should invoke TypeSetting.
- “Latex Environment”-Commands should enclose Text and TypeSetting locally within a Document. A “Latex Environment” is a CodeArea where specific Rules operate on the Commands you write.
- “Latex” should be able to integrate Computing- and Information-Technologies in a scalable Manner, i.e. the Technologies should scale (i.e. cover small or large Task).

[17] These Ideas are a Pattern seen in the Latex. Obviously, someone must to read about the Requirements behind Latex about what the Creators thought.

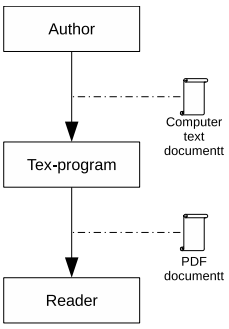


Figure 34.2: The digital PublishingProcess

You can consider “Latex” as a ProgrammingLanguage [18] that defines the Way of how the Text will be displayed on a Piece of Publishing-Medium, such as Paper. Therefore, the Author, who is also Editor, issues **Commands** and the **ReaderContent** is typeset accordingly.

Worth to note, that similarly to Programming, you compile (use the verb “typeset”) your SourceFile(s) (of ComputerFormat **tex**), in Order to generate an OutputFile of usually **PDF** Format. See figure 34.2.

[18] In this Case a “Markup”-Language

Chapter 35

Administrative Issues

Narrative

This Chapter describes the **administrative Issues of "Latex"**, so that the Learner can understand how "Latex" views its most basic Resources, its **Functionality** and its **Concept**.

35.1 The Constituents of Latex

A Constituent is a Part that directly contributes to something Bigger. The Constituents of Latex are all these Parts that contribute to Latex as System for preparing Documents.

The Demand for Simplicity on the Issue of "TypeSetting"-Complexity of a Document is the driving Force of the "Latex". When we approach "Latex", we need to address all the Constituents that act for the TypeSetting, the logical Structure and the Content itself. Here we must consider the following Aspects:

1. **Content and Objects**: This is the Material you need to convey to a Reader. It contains Text, Graphics, Illustrations, Tables, Colors and even ComputerFiles as well as active Content for "electronic Document"-Creation. In other Words, this is the conveyed ReaderContent.

2. **Logical Structure**: This is the Material you need to convey to the Reader about *how you view your ReaderContent*. E.g. which Information is for Chapters and which for Appendix.

3. **Logical Structure in "Latex"**: this is the Material you edit in "Latex" and concerns the *Logical Structure of your Content in "Latex" itself*. It affects, in "Latex"-Terms, the logical Structure of the Document. This Material is not visible to the Reader.

4. **ScriptCommentary**: this is the Commentary on the Commands you edit in Order to keep for yourself the Details of the various Aspects of the Commands themselves. Remember that Commands can be configured, i.e. a Command can act in different Ways and you may have to remember what the Parameters of the Commands mean and for which Purpose are deployed.

5. **TypeSetting**: This is the Material you need to convey to the Reader for his visual Attention to the Content.

6. **"Latex"-TypeSetting**: This is Material you edit in Latex and concerns the Structure of TypeSetting itself.

35.2 Additive and logical Structure of a Document

By running the "Latex"-SoftwareApplication, you enter the Territory of "Latex". You can start directly with just few Commands and then write down your Content and Editing. However by doing this, you might follow to the Illusion of Latex: that Latex can provide rapid Preparation of a Document. Such an Illusion is a Source of endless Tears, as well as Proliferation of broken Computers which where the Victims of the Rage of Authors! Latex is not an easy System on its own since it provides a logical Structure for DocumentPreparation and not an additive Structure.

An **additive Structure in an Object** is that the Object is created by adding Parts; for an electronic Document that would be Text, Paragraphs, Tables, Pictures etc.

A **logical Structure in an Object** is that the Object is created by deciding first what Structure best accomodates the Function of the Object and then which Components deliver the Functionalities of the Object in complete Concordance to the Design; for an electronic Document that would be the Template for the Document and the Commands that offer the best Integration of their Functionality to the DocumentStructure.

The additive Structure has the Benefit of rapid Deployment of ReaderContent. Its Hazard is the Luck of Stability which increases as the Document becomes larger.

The logical Structure has the Benefit of Stability that can be scaled as the Document becomes larger. Its Hazard is the slow Deployment of ReaderContent.

Consequently, I will not engage in rapid DocumentPreparation here: this is for "Pussies". Thank you.

35.3 Methodology for DocumentPreparation

The Methodology for DocumentPreparation that I use with "Latex", *ideally*, is the Following:

1. Get a small Notepad to record the Effort concerning the Use of Latex and the Ideas of the Publication you want to add. Remember that before you write your Comments within, you write also the Date, i.e. *When and What.*

2. Collect the EffortMaterial of your Endeavor in one Place.

3. Arrange the EffortMaterial for easy Access and Clarity. Creativity rarely comes good in ugly Places; we need to get ugly inside, not to make ugly our Bureau [1] .

4. Write, if you haven´t done so, the Content for your Reader in electronic TextFiles. These Files end with "txt"-Extension and we just call them "Contents".

5. Notes that should be shown handwritten should be added as Pictures in the "Latex"-Project.

6. Design or collect Illustrations, Pictures and DataTables in their Format. These are the Objects of the "Latex"-Project that we need to add together with Text.

7. Add to your TextFiles the References to the Objects without any "Latex"-Marking, E.g. Reference: Picture of Item, Table X, Illustration Y etc.

8. Determine before you start the "Latex"-Editing, the DocumentLayout you intend and the Sizes that

[1] Creativity is like Sexual Intercourse, is dirty: Saliva, Sperm, Blood from Period, and I haven't mentioned the BDSM Staff!

the Pictures and Diagrams will hold in the Document. Make rough Estimates and use Books that you like as visual Reference for your Project [2] .

9. Create a ComputerFile for the logical Structure of the Reader concerning the Content and the Objects.

10. Create the "Project"-FileStructure in your FileDirectory.

11. If there is any Brain left in your Head [3] , use a **"Revision"-ControlSoftware** to *track the Changes in the "ProjectFiles"-ComputerDirectory.*

12. Copy the Content, Objects and StructureMaterial in the Project-FileDirectories, and if you own a "Revision"-ControlSoftware, make the "BaseLine"-Revision of the Material. **This should be done before the Material is opened by the "Latex"-Software!** [4]

13. Start the "Latex"-Software and create the main "Latex"-Document AKA RootDocument with the DocumentStructure, Colors, Fonts, Packages, and References to Computer-Files.

14. Run the Document for a Preview.

15. Start to copy the TextContent to your "Tex"-Files and edit each File.

16. Continue the "copy and edit"-Process until you edit the entire EffortMaterial in a PDF-Document. Prepare for Errors and resolve them by reading the "Tex"-Documentation [5]

That's it. I forgot to mention that before you start this Effort, you will need to get trained. Inside this Text I provide you Exercises for your Training. Lets now hit our Steroids!

35.3.1 DocumentGranularity and "DataInclusion"-Commands

You can write a Document in a single File, compile it, and then publish it.

Because real Documents are large, you will notice after the first 100 Lines, that the Document is difficult to maintain and correct due to its problematic Visibility [6] . For this Reason real "Latex"-Projects are divided into many "Tex"-Files, that are usually administered from other "Tex"-Files. In this way, we can edit the ReaderContent, and then displace the ReaderContent anywhere in the EndProduct, just by editing the Location where it appears.

Def. 35.3.1.1*:* **DocumentGranularity (Latex):** is the FilesAmount a "Latex"-Project has in Order to model the intended logical Structure of the "End"-Product.

During the "Latex"-ProjectDevelopment an important Aspect is to correctly manage the TextFiles, the logical Structure of the "Latex" and of the ReaderContent. Keeping the Granularity of the "Tex"-Files appropriate can save Time. The "Tex"-Files are included in a ComputerDirectory and then are referenced by InclusionCommands in another ComputerFile.

[2] You should avoid to reinvent the Wheel, get Ideas from others about your Work.

[3] Actually I doubt if you ever had a Brain, but lets leave this to the Coroner and the Historians of the Future to decide.

[4] The Reasoning for having the Materials before the actual ProjectCompilation is to avoid any Situation of corrupting Data. We are all Idiots that make mistakes; I just try to shield you from a "well defined"- Danger, since I have been there as Idiot. Life is hard but at least it gives you many Opportunities to be an Idiot: Choose wisely.

[5] Observe with Pleasure the Color of your Hair to fade and your Libido reduced to zero. Awesome isn't it?

[6] Professional Publishing involves *an Army* of experienced Professionals that takes Care of the Details. If you are reading this Document, you are probably on your own. As I say to "terminally Ill"-People, *Good Luck*

Def. 35.3.1.2*:* **“DataInclusion”-Commands:** are the Commands send to the “Latex”-System in Order to include the “ReaderContent”-Files.

35.3.2 “Latex”-Files

A “Latex”-file is a TextFile of particular “ComputerCharacter”-Encoding [7] that contains the “Latex”-Commands, their Comments, as well as the Content and Objects that are Part of a real (read *Human-friendly*) Document. See next Listing for an Example:

```
\input{BundVorlage} %Commentary: This is the Swiss
      Template
\begin{document} %Commentary: Initialization of Document
   \mainmatter %Command for written Material
   %Commentary: This is the Tex-File with the
         TitleInformation
   \input{Title_TheCrystalSkull}
   %Commentary: Each Tex-File is a Chapter
   \input{Story_Chapter_01}
   \backmatter
\end{document}
```

A “Latex”-File has a “User defined”-Name as well a standard FileExtension named **“tex”**. In Reality there is no “Latex” Files, only “Tex”-Files. However when Students speak of “Latex”, they speak of “Latex”-Files while experienced Persons speak of “Tex”-Files. “Latex” is a Simplification of the “Tex”-Technology devised by Lamport (*May His name recurse to the Centuries*).

I use “Camel”-Case for the Names of “Tex”-Files, with the only Punctuator, that is the Point, to separate the Title from the FileExtension. E.g. CommandsOfLatex.tex is a Tex-File with Title “Commands of Latex”. The next Paragraphs explain this System.

35.3.2.1 Capitalization and Naming in Latex

In Latex we use Commands to deliver Processes. The ComputerFiles affected by these Commands are frequently capitalized for easy Discrimination of their Name.

[7] ASCII (used in Colony) or Unicode (used everywhere else)

Capitalization is the Changing of Characters from small to large as Symbols but not as Size. By Definition:

Def. 35.3.2.1*:* **Capitalization (Grammar):** is the ChangingProcess of written Characters where the “lower Case”-Characters become “upper Case”-Characters.

E.g. The Sentence “I keep the Dog home” when capitalized becomes “I KEEP THE DOG HOME”. Despite my heroic Efforts, I haven’t found a Way to capitalize the Character “Space” ☺.

WordBounding is to separate Words so that they can be identified. This is defined as:

Def. 35.3.2.2*:* **WordBounding (Grammar):** is the Separation (i.e. Bounding) of the written Words by a Symbol or SymbolAbsence (AKA Space).

E.g. The Sentence “TimacknowledgetheRulethatHeikocreated” is written with WordBounding as “Tim acknowledge the Rule that Heiko created” when for Bound the empty Space is used.

Medial Capitalization is to use WordBounding but as Bound to Take the capital written Character of each Word. This is defined as:

Def. 35.3.2.3*:* **Medial Capitalization (Publishing):** is the WordBounding by Capitalization of the first Character of a Word in a Sentence or compound Word.

E.g. The Sentence “I went to Rome for a Weekend” becomes “IWentToRomeForAWeekend”.

Since in ComputerProgramming there is a Demand for long Words, the medial Capitalization is used in compound Words and is called “ “Camel”-Case ”.

Def. 35.3.2.4*:* **“Camel”-Case (ComputerProgramming):** is the medial Capitalization of compound Words that serve as Identifiers in a ComputerProgram.

E.g. “System12ExponentMarker” instead of “System_12_Exponent_Marker”.

35.3.2.2 The PDF-Format

The most common “OutputFile”Format for “electronic Document”-Publication is the *Portable Data Format*, **PDF**. The PDF was developed by **ADOBE**™ based on earlier Work by **Hewlett-Packard**™, and defines the DataForm that will appear as a “Human readable”-Document. **The PDF-File is the Product arriving to the Reader**.

Note: “professional Printing”-Publishers and PrintingFacilities accept the PDF-Format as well as the “Latex”-Format. With the Advent of TabletComputers [8] , other Formats are also available such as the “electronic Publication”-Format (epub), which I will not consider in this Work since it was made for Sissies i.e. “E-book” Readers; *we are “Christians” here, we read on Paper.*

35.4 The “User”-FileSystems

Because real scientific Documents such as Books and Manuals tend to be large, the **Strategy of Division and Conquest** applies to our Efforts; The intended Document is broken into **Sections** (i.e. DocumentParts) where each Section is self contained. Speaking of Computers, each Section is made up from a **File**, called “secondary File” and there is a “primary File” that describes the “Aggregate of Files” and thus invokes the secondary Files, i.e. the primary File contains Commands to invoke secondary Files. A secondary File might also invoke other Files or it contains pure Content for the Reader.

[8] Probably someone had the Idea of the best possible Method to realize Computing in the ToiletRoom, -on the Way he discovered the Benefits of “Adult”-WebSites

E.g. The primary File is described in this Listing, together with References for invoking the secondary Files.

```
%This is File called "Document.tex"
%and is a primary File
\input{FantysyFiction_Template}
\begin{document}
   \mainmatter
   %Secondary File#1
   \input{Title_TheCrystalSkull}
   %Secondary File#2
   \input{Story_Chapter_01}
   \backmatter
\end{document}
```

E.g. The secondary File is described in this Listing, together with a Reference for invoking a Picture.

```
%This is File called "Story_Chapter_01.tex"
%and is a secondary File
\chapter{The Encounter with the Chantress}
As the Witch wears her CrystalDress,
the Knight was surrounded by Dworks...
\begin{figure}
   \centering
   \includegraphics[scale=0.3]
      {TheCrystalSkull/WitchCrystalDress.eps}
   \caption{The Dress of the Witch}
\end{figure}
```

The “Latex”-DocumentDevelopment starts from laying down a “User”-FileSystem (AKA FileDirectory) where the “Latex”-Project derives. **This Task is done first on Paper and then on a “Computer”-FileDirectory**. There are two Options available:

- **“Category”-FileSystem**: Create inside a your own “Computer”-FileSystem a ProjectDirectory (i.e. a FileDirectory for your Project). Then within the ProjectDirectory you create FileDirectories for each Categories of Objects you intend to use in your Document (e.g. DocumentDirectory, PictureDirectory, DataDirectory etc.). See Figure 35.1.
- **“Chapter”-FileSystem**: Create inside a your own “Computer”-FileSystem a FileDirectory for each Chapter and add inside it the Items (Documents, Pictures, Data etc.) that support your EffortMaterial for each Chapter. See Figure 35.2.

Between these two FileSystems, there is a Spectrum of Possibilities and Customizations. After you finished with the DirectoryStructure, create a “Tex”-File at

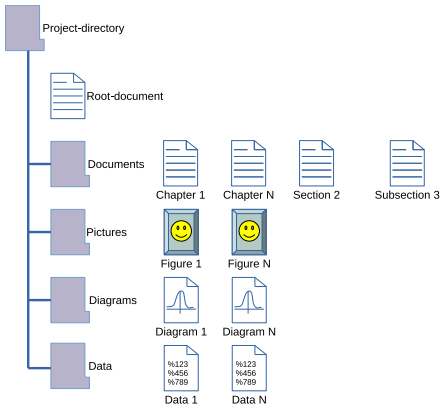


Figure 35.1: The “Category”-FileSystem

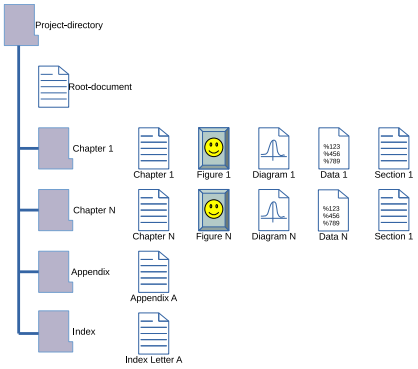


Figure 35.2: The “Chapter”-FileSystem

the Top of the Subdirectories. This is called **“Root”-Document** or **“Base”-Document** or **“Root”-File**. This “Tex”-File will contain the *EditingInformation* and will invoke the main “Tex”-Files. Each of these “Tex”-Files might have none or one or more “Calls” (i.e. Invocations) to other “Tex”-Files or Objects to be included.

35.5 Regulation of white Space in a “Latex”-Document

A SourceFile with FileExtension **“tex”** contains the Material for the Document. This File will be processed by “Latex” with a Layout defined by a Template. In Latex there are two Types of Templates: Templates from “Latex”-System and Templates provided by independent Developers of “Latex”. The independent Developers typically base their Templates on the “Base”-Templates of “Latex”-System. The Templates are derived by a System of DocumentTemplates called “DocumentClass” [9]

The “Latex”-Software during Compilation will break the Text into Pages, Paragraphs, and TextLines together with auxiliary AdministrationTasks for the Document, such as PageNumbers. This is done according to the Template that is used, i.e. There are specific Rules for each Template that the generated Document should obey.

The SourceFile has a certain Elasticity of generated **white Space** as “WordBounding”-Separator in the Sense of typing the Material: the “Latex”-System will try to make the Document to contain white Space in a balanced Fashion. To understand this, you must understand that there are two white Spaces concerning Text in a Typewriter: the “Interword”-Space and the “Interline”-Space.

[9] A Class, colloquially as Term, defines a View on related items. Here the related items are DocumentTypes.

The “Interword”-Space is generated with the “Space”-Key [10] while the “Interline”-Space is generated with the “Return”-Key.

For the “Space”-Key, one Hit on it, will forward the Cursor of the Typewriter one Character forward-right by jumping one CharacterSpace in between.

For the “Return”-Key, one Hit on it will forward the Cursor on the next TextLine below the former TextLine [11]

E.g. The following Text demonstrates both white Spaces:

```
This is a          Text
with variable    Interword-Space


and Interline-Space above this
    sentence.
```

There is also another SpaceType that is Part of the “Latex”-System and this is the “Interparagraph”-Space. With Typewriters, the “Interparagraph”-Space was delegated to the use of “CarriageReturn”-Key.

In Latex, there are certain Rules about the generated white Space:

- **Blank Space** (of one Character) or **multiple blank Spaces** do not affect the “Interword”-Spacing of the final Document. E.g. In a TextDocument, “My old Lady” and “My old lady” all become “My old lady” after generating a PDF-File. Note that this Rule applies also to blank Space in the front of the TextLine. In Addition, the “Latex”-System will adapt the Structure of the Texts to the LayoutRules for the particular Template in Use which means that Sentences will be broken within the same Paragraph.
- **One CarriageReturn** does not affect “Interword”-Spacing. E.g. “My old Lady”

  will become “My old Lady”. However, this is Part of the overall TemplateRules! That is, if the Text must be broken in the Paragraph then the Text will be broken.
- **Empty Lines** or **multiple empty Lines** generated by the free Use of “CarriageReturn”-Key do not affect the “Interparagraph”-Space. A new Paragraph can be made by the **“par”-command** but normally two consecutive “CarriageReturn”-Hits will produce an empty Line that after it a Text will be treated as a new Paragraph. Note that when you start to write to a new Latex-File, the first Text becomes the first Paragraph.

35.5.1 CarriageReturn and WordWrap

When we are using a mechanical Typewriter to imprint Characters on Paper, we have a specific Amount of printed Characters that can be displayed on the Paper and this is about 72 Characters per TextLine. On a ComputerScreen this Number can be varied but a ComputerScreen is not Paper: there can be no Limit to a ComputerScreen since a ComputerScreen has nothing to do with Paper; *it can model Paper but it is still not Paper.* The Amount of Characters on a ComputerScreen depends on the Resolution (i.e. graphical Detail) of the Screen and eventually can become larger as the Resolution

[10] Or by blanking with actual Paint the ComputerDisplay if you are Fake-Blond.

[11] The Terms “Return”-Key and the “CarriageReturn”-Key are frequently found in ComputerLiterature. Here some explanation. In Computing the “Return”-Key has the Function to enter Data to the ComputerSystem by typing the Data and then by pressing the “Enter”-Key. In “TextEntry”-ComputerPrograms, the “Enter”-Key took also the Role of “CarriageReturn”-Lever, where its Displacement forwards the Drum of the Typewriter so that the Paper wrapped in the Drum will be displaced one TextLine below the former TextLine. Back in my Childhood, I remember that ComputerKeyboards had the Term “Enter” inscribed to them on the “Enter”-Key, while ComputerKeyboards for pure TextEntry had the Term “CarriageReturn” or just “Return”. Despite Differences, irrelevant to the Context, the Secretaries were beautiful in any Case.

increases every new Generation of ComputerScreens. Similarly, the Amount of Characters on a ComputerFile depends on Amount of Storage, and since a ComputerFile stores a CharacterSequence of Characters, one Character after the other (including ControlCharacters for Description of Concepts such as new TextLine) then there is no Concept of a TextLine under another TextLine: the TextLine is extremely long.

TextSoftware and ComputerPrinters were faced early on with the Problem of Amount of Characters printed. Many ComputerPrinters got a maximum Size of Characters in a TextLine of 80 Characters for physically displaying legible (i.e. readable) Characters.

In a Computer the standard Practice was to enter Text and once you reach the Margin of the modeled Document-Paper on ComputerScreen you will press the “Return”-Key (short for “CarriageReturn” in TypeWriters) for forwarding the ComputerCursor to the next TextLine.

A ComputerTechnique to automatically append a new TextLine after the Cursor reached the 80th Character had two Implications, one considered “soft” and another considered “hard”.

The “soft” Technique, called “WordWrap” continues the written Text on a new TextLine below the former TextLine but will not add any “CarriageReturn”-Character after reaching the 80th Character. The “hard” Technique inserts the “CarriageReturn”-Character after the 80th Character. By using the “CarriageReturn”-Character the EditingOptions of the Printer were enhanced, since there was Availability of “Interline”-Space and “Interparagraph”-Space. Later with WordProcessors the Situation changed radically since it was possible with embedded Commands to automatically change the Appearance of the Text.

In our Days, the Author can write freely without to consider to press the “Return”-Key after 80 Characters but many “Tex”-

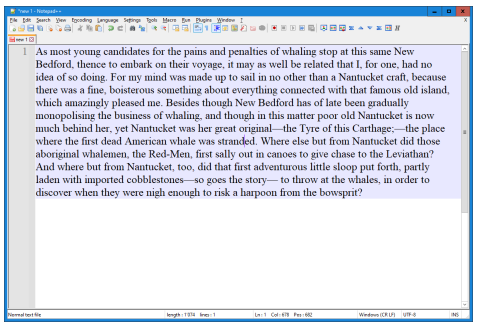

As most young candidates for the pains and penalties of whaling stop at this same New Bedford, thence to embark on their voyage, it may as well be related that I, for one, had no idea of so doing. For my mind was made up to sail in no other than a Nantucket craft, because there was a fine, boisterous something about everything connected with that famous old island, which amazingly pleased me. Besides though New Bedford has of late been gradually monopolising the business of whaling, and though in this matter poor old Nantucket is now much behind her, yet Nantucket was her great original—the Tyre of this Carthage;—the place where the first dead American whale was stranded. Where else but from Nantucket did those aboriginal whalemen, the Red-Men, first sally out in canoes to give chase to the Leviathan? And where but from Nantucket, too, did that first adventurous little sloop put forth, partly laden with imported cobblestones—so goes the story— to throw at the whales, in order to discover when they were nigh enough to risk a harpoon from the bowsprit?

Figure 35.3: Notepad++ Text-Editor with wrapped Text.

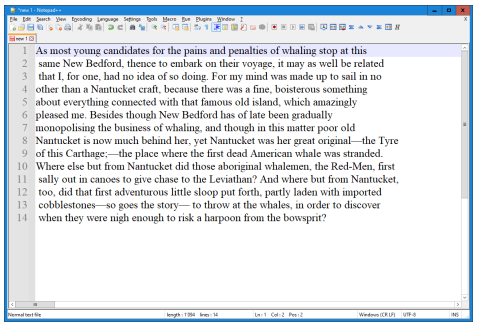

As most young candidates for the pains and penalties of whaling stop at this
same New Bedford, thence to embark on their voyage, it may as well be related
that I, for one, had no idea of so doing. For my mind was made up to sail in no
other than a Nantucket craft, because there was a fine, boisterous something
about everything connected with that famous old island, which amazingly
pleased me. Besides though New Bedford has of late been gradually
monopolising the business of whaling, and though in this matter poor old
Nantucket is now much behind her, yet Nantucket was her great original—the Tyre
of this Carthage;—the place where the first dead American whale was stranded.
Where else but from Nantucket did those aboriginal whalemen, the Red-Men, first
sally out in canoes to give chase to the Leviathan? And where but from Nantucket,
too, did that first adventurous little sloop put forth, partly laden with imported
cobblestones—so goes the story— to throw at the whales, in order to discover
when they were nigh enough to risk a harpoon from the bowsprit?

Figure 35.4: Notepad++ Text-Editor with not wrapped Text where the User every 80 Characters presses “Carriage-Return” to go to the next Text-Line.

Editors still use as matter of Style the “Return”-Key. In the picture 35.3 the Text is written and after you reach the “TextLine”-End you press “Return”-Key while in 35.4 the Text “wraps”, it continues under. Note that when you press the “Return”-Key, it is written in the ComputerFile a ByteCode. When your Text wraps, there is no such a ByteCode. The ByteCode represents the ControlSequence “CarriageReturn”, CR.

35.6 DocumentClasses

A “Document”-Class describes the Structure of a DocumentType. Consequently the “Document”-Class is a Template where the “Latex”-Editor develops an actual Document from the Author.

Def. 35.6.0.1*:* **“Document”-Class:** is a Template for a Document in the “Latex”-Document.

Here is a brief Explanation of some Classes.

1. An **“Article”-Class** is the Template used for the Creation of mostly scientific Articles.
2. An **“Book” and “Report”-Class** is the Template used for the Creation of mostly scientific Books and Reports.
3. An **“Letter”-Class** is the Template used for the Creation of Letters [12]

Note that these “Document”-Classes have their own Properties concerning Typesetting and PageLayout, but the User can also shadow i.e. hide some of their Properties according to his Requirements.

35.7 “Latex”-DocumentStructure

There are two Types of “Tex”-Files present in a “Tex based”-Project. These are:

1. *Def.* 35.7.0.1*:* **“Root”-File AKA “Root”-Document:** is a ComputerFile containing the “Document”-Class, Styles and “Reader”-ContentStructure.
2. The *ContentDocument*. This Document also contain Invocations to Graphics or other FileTypes.

A **“Root”-File** has the following Characteristics:

1. A “Commentary” about who created the “Tex”-File.
2. A Description of the DocumentType (the Document’s Class) that the implemented Content will follow.
3. A Set of LibrariesDeclarations for accessing various Text- and GraphicsCommands (the Document’s “Packages”). This Part is declared in the Area before the Document, called the **“Preamble”** [13] .
4. The ContentDocument i.e. the Text that will appear in the printed Version.
5. Calls to various external Documents that form the DocumentParts, e.g. Chapters, Appendices etc.

A Commentary about FileOwnership is here:

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%     Company: ACME Unlimited
%     File name: Chapter01.tex
%     Date: 22-01-2025
%     Version: 1.1
%     Author:   Neufelt Christopher
%               Xstrasse 41
%               Schweiz, Switzerland
%               xxx@FirmaEmail.com
%               Tel. 0041-(0)12 34 567 89
%     Description: Monica meets Cate for the first Time.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

The Commentary can be automatically generated by Use of administrative Facilities of the “Latex”-Software. Typically the Commentary will be at the Beginning of the “Tex”-Document.

The ContentDocument can be one “Tex”-File but usually will be two or more “Tex”-Files. These are:

1. A “Tex”-File containing “Calls” to other “Tex”-Documents as a DocumentContainer.
2. A Document containing ReaderContent (the Crap you write) as well as “Calls” to Documents and Graphics.

Now get a Hell out of this Chapter!

[12] This Class obviously was created for the Romantics: *com’ on Baby, I wrote you this Letter with the Navier Stokes Equations* 💀.
If someone was remembering to use a Condom, we wouldn’t have this “Document”Class.

[13] The “Preamble” technically speaking is the Area between the “\documentclass”-Command and “\begin{document}”-Command, see [Mittelbach et al]: Mittelbach, F, Goosens, M. The Latex Companion. Addison Wesley, 2004.

35.7.0.1 Book structure and objects

The Book-Structure of a real Book should be now defined. It consists -roughly- of the following Categories[14]:

1. Title-page
2. Table of contents
3. Front-matter which contains:
   I Foreword
   II Preface
4. Main-matter, which contains the so-called "Parts". Each Part consists of:
   I Chapter
   II Sections
   III Subsections
   IV Paragraphs
5. Back-matter, which contains:
   I Appendixes
   II Glossary
   III Bibliography
   IV Index

The **Matter** is an administrative Division of the Book. The content for the Reader is actually the main Matter, while the front Matter and the back Matter serve more or less as a Reference.

There will be Graphics displayed called for our Purpose **Objects**, and these are 5 Categories:

- Pictures is an Image taken from a Machine.
- Illustration: is a graphic Interpretation of the Reality made by an Artist.
- Table: is an Arrangement of Data on Paper.
- Diagram: is a graphical Arrangement of Information
- Mathematical Formula: is a Notation of Scientific Content fitted for Mathematics [15]

A Question arises, and this is, how to write a Book. This is easy: you start to write and then you add Things. Finally you create a Structure and you use it. Well...If you want the real Answer, you can get to a Book-Catalog and find how to write a Book or how to design a Book.

[14] Worth to note, that depending on Effort, Time and Detail, there will be a Spectrum of Possibilities. Here we try only the most important Parts of **Book-Design**.

[15] This is the primary reason behind the development of TeX

Chapter 36

Practical DocumentStructure

Narrative

The Practice of DocumentStructure is described here. It concerns the SoftwareApplication in Use, as well as the Creation of the DocumentStructure itself, together with the Bits and Pieces that glue the DocumentStructure. In a Section of this Chapter, most of the TrainingMaterial will come in one Place in Order to for you to create a practical Example.

HumanMemory and Latex

Frequently a Question arises as follows:

How many Commands do I have to learn?

The Answer is none!

You only need to answer Questions and understand the Philosophy of "Latex".

Eventually you can learn 10-20 Commands, but in any Case you need to write down some special Commands that you encountered. Myself, I cannot memorize precise Things due to metal Disability [1] , so I wrote this Document and I use it. Whenever I need to understand some Aspects of "Latex", I read the "Latex"-Documentation of TeXstudio, Articles, Contents of Fora, and when Time allows "Latex"-Documentation. Therefore, keep your Eyes open on official Documentation and your own Document.

Eventually "Latex" will be replaced by someone more clever than you, an *artificial Intelligence*, but you still have Time till **that** Singularity.

36.1 The four Aspects of the "Latex"-Document

It is difficult to speak about how to construct a Document for a ReaderContent and how to speak about the DocumentStructure as a Subject on itself. For this Reason, this *Metadescription* [2] here will be sufficient. In this Metadescription I give roughly the Definitions of the Aspects of "Latex".

The four Aspects of the "Latex"-DocumentStructure are:

1. **"Latex"-Commentary**: The Commentary about the "Latex"-Programming. This is unknown to the Reader.

2. **"Latex"-Commands**: The Commands that perform Editing. These are unknown to the Reader.

3. **"Latex"-ContentStructure**: The internal Structure of the Docu-

[1] I wanted to write "mental" but "metal" is also fine

[2] The Term "meta", describes something after the Term. The Metadescription is the Description about a Description.

ments that are used for "Latex"-Programming. This is unknown to the Reader.

4. **ReaderContent**: the Content and its actual Structure that the Reader perceives.

Next I will give a Description for each Item mentioned thoroughly. Don't worry, I will also use genuine LatexGloves for the (Re)Search full with Vaseline™and it will be quick and less painful. Now bend down.(!).

Questions and Exercises

Take an "A4 Size"-Paper or a "Letter Size"-Paper and set it on "Portrait"-Form. Divide it along its Height with a thick Line. Keep this Paper nearby and first read a Section of this Book and if the Section contains Commands, write every Command (without Explanation) and a small Example. This will keep you focused since the major Difference of ProgrammingLanguage and "Latex"-Editing is the different Process that each one Programming focus: typically a ProgrammingLanguage is for live SoftwareApplication while "Latex" is for creating a tangible Document, i.e. a Book, which is a static Operation and consequently difficult to memorize (i.e. without Experiment, is difficult to remember). You will be messed up by reading about Editing and it's Programming. In Addition you should create a real SoftwareExample, only when it is required a SoftwareExample. Understanding how Commands work, here is a Virtue!.

36.2 "Latex"-Commentary

A "Latex"-Commentary is a **Thought** directed at the Person who edits a "Latex"-File, and is a metalinguistic Aspect of "Latex"-Editing, that is, the "Latex"-Commentary says something about the "Latex"-Programming, *not about the Content that the Reader will read.* That is why a "Latex"-Commentary will not be added to the "End"-Product. Consequently the "Latex"-Commentary is a Metadatum.

A "Latex"-Commentary inside a "Latex"-File is anything written after the Percent Symbol, **"%"**, and it is considered a "Latex"-Comment for the rest of the TextLine; in this way internal Meaning of the "Latex"-Document itself takes Place. This internal Meaning concerns the Editor of the Document and not the Author of the Document [3] . An Example of "Latex"-Commentary is the following TextLine, that can be placed in a "Tex"-File:

```
%Here I must put chapter 3
```

The Effect of the CommentSymbol, %, persist until it encounters the LineEnd. The LineEnd is signified by a CR or LF or CRLF "ASCII"-Character.

Questions and Exercises

1. Create a "Latex"-Commentary on your Paper. E.g. % Leroy and Hans were here.

36.2.1 What you should comment

Inside a "Tex"-document, you should mainly comment:

- **Rarely used Options that affect Commands.** This is especially nice, since People forget. Do you remember what you ate before two Weeks [4] ? If a ComputerFile eats Data, you want to know what you fed him [5] .

[3] This is the MetalanguageConcept found in UML, where a Metalanguage defines the Terms and their Use for describing a Language.

[4] Haha! The less you remember the better you'll sleep at Night!

[5] Yes, for me the Computer is a Male.

- **New Commands that you developed.** Most of the Commands are already in Latex, but once your Wife leaves you for your GirlFriend, you might "reinvent the Wheel" i.e. you might develop new Commands which after a Week you don't have a Clue what they are about.

- **The Reason you invoke the particular "Package"-File.** Some "Package"-Files can conflict with other "Packages" and is good to know what causes the Conflict (of course is YOU!). Perhaps you can replace a Command with another [6] .

- **The StructureType of Document you intend.** It is true that Code should be self documenting, but a short Comment always helps.

However,you should never comment the obvious [7] .

Questions and Exercises

1. What you should comment?

36.2.2 End-Product-Comment

Sometimes you stumble to a ReaderContent that actually needs to be revised, but Time does not allowed it. In this Scenario you need to leave a Comment to the Author of the Document. Here you must understand (though I really doubt; I still love you though), that in a DocumentPreparation some Content might be problematic (either on Data or their Formulation or on Objects (Pictures, Tables, Charts) that are used). A Comment concerning the "End"-Product will alert the ContentCreator or "Latex"-Editor directly on the Location of Conflict. A nonstandardized Method for commenting on ReaderComment is to use an "End Product"-Comment. This is a Comment directed to the ContentAuthor and **intends to be removed before publishing the Document**. The "End Product"-Comment can contain:

- Names of possible Sections.
- Tasks to do.
- Tasks to define.

Typically this Comment is inside a Command that prints the Comment red-colored in the PDF-File, so that the Comment is highlighted.

36.2.2.1 A personal Command for Commenting on ReaderContent

In my "Latex"-System I have the Command "\atcn" (at CN, i.e. this comments targets me, CN, Christopher Neufelt) defined as:

```
%The Command ''atcn'' performs
%a red Comment targeting the Author
\newcommand{\atcn}[1]
{
   \textcolor{red}
   {
      \textbf{At CN}: \emph{#1}
   }
}
```

So when I include the command with argument:

```
\atcn{Check the Text for
    Inconsistency.}
```

This will print:

Check the Text for Inconsistency.

The "End Product"-Comment seems a little bit an Overstretch but as you start to edit your Document, you will see that is better to keep the Things clear, that

[6] , similarly when you broke up with Jill to get as Boyfriend her Father.

[7] This is like a BoyFriend: you don't write to his T-Shirt "BoyFriend" but you hold his hand. In this way the Context of Relationship is obvious (You are Gay!).

is, “Latex”-Editing and “ReaderContent”-Editing, than to run only to your Notes. The best Approach here is that you review from Time to Time your Document for such “End Product”-Comments.

Note that “Latex”-Software can have its own Set of Commands for Review and Commenting the Content.

Questions and Exercises

1. Copy the Command on Paper and Edit it so that the Acronym CN will now contain your Acronym. This Mechanism you will use much later, but is good to have it ready.

36.2.3 “Commentary”-PageSeparator

Back to the good ol’ Days where Life was expensive and Sex was cheap, the ProgrammingWork involved the Sectioning (i.e. make the Separation of DocumentParts visible) of the electronic File by means of commented Hyphens **-** or any other Punctuator available.

E.g. PageSeparation by Hyphen and Asterisk

```
%- - - - - - - - - - - - - - - -
```

e.g.

```
%******************************
```

A **“Commentary”-PageSeparator** is a commented String of a single Character used as a Delimiter (i.e. a Separator) of Paragraphs or Sections of the same File. It is usually 80 Characters long (including CommentCharacter) and might contain a Text within such as the Name of its Section.

E.g. “Commentary”-PageSeparator provides Separation as well as a Commentary

```
%***Packages used for Fonts***
```

The “Commentary”-PageSeparator is mostly used to add **Headers** in the Code concerning something about the Context of the File as well as Information on who created the File. More on this later.

Note: The 80 Characters is a Baggage left from the Days where the Computer-Printers could only produce 80 Characters in a TextLine. It is still (2025) a nice Method for printing and reviewing ProgrammingCode.

36.3 “Latex”-Commands and “Latex”-Environments

In this Section I will introduce formally the Commands together with their administrative Effects. More Details on Constructions will come to the later Chapters.

36.3.1 “Latex”-Commands

“Latex”-Commands are Commands to the “Latex”-System for the Purpose of TypeSetting as well as Inclusion of special Items, such as Symbols and Punctuators.

E.g. The Command “\textbf” prints ReaderContent as “Bold”.

```
\textbf{This is bold TypeFace.}
```

which Produces in a Document:
This is bold TypeFace.

“Latex”-Commands can be customized by entering to them special Information. The Commands can act globally or locally to the available Objects such as Text and Graphics.

The Term “DeclarationForm” can be found instead of “Latex”-Command.

36.3.2 Form of “Latex”-Commands

A “Latex”-Command, has many Aspects that need to be explained.

A **“Latex”-Command** is always associated with a **“Latex”-Package**, which defines the Name and Action of the “Latex”-Command. I.e. a Command is fully described as a named ComputerCode in a Package.

A **“Latex”-Field** in a “Latex”-Command, is a delimited Area (by Braces or Brackets), that has the Purpose of enclosing to the “Latex”-Command the either the Settings (**InputParameters AKA Arguments**) or Text.

A “Latex”-Field configures the Action of the “Latex”-Command on the **Output-Document** based on either the **InputParameters** (present in the “Latex”-Field) or simple affects the followed Text.

A “Latex”-Command can have none, one or more “Latex”-Fields.

A “Latex”-Command is preceded by a **“Backslash”-Character**, \. Exception to this rule is the **“Dollar”-Sign**, which indicates an **inline “Formula”-Environment** , i.e. a local Area where the Code acts [8]

E.g. In Metalinguistics, the Command-Form for “Latex”-Commands is:

```
<CommandForm>:= "\"<CommandName>
```

Comparing with the CommandForm for an Environment with Formulas is:

```
%Formula-environment:
$<Formula definition>$
```

A “Latex”-Command is terminated by Whitespace (snown here *as Underscore*) or Dot (i.e. Period).

E.g. Termination of “Latex”-Command:

```
\textbf_
\textbf.
```

A “Latex”-Command is “Case”-sensitive, that is, it should be written with the correct CharacterCase in the Name given.

E.g. Comparison of a right and false written Command, the Command “\length”:

```
\length %Correct writing
\Length %Incorrect writing
```

The “Latex”-Fields can be optional or obligatory.

A “Latex”-Command can have more than one “Latex-”Fields, depending on the Requirements imposed on the Command. A “Latex”-Field is an Area of Data or Controls.

An **optional “Latex”-Field** has **Brackets,** [ ], and is intended for the Customization of the “Latex”-Command.

E.g. The Command “\documentclass” has in Brackets various Texts that list the Options to be selected by the Command. For Example the Optional Field with the Value 10pt.

```
\documentclass[10pt]{book}
```

An **obligatory “Latex”-Field** has **Braces, { }**, and is intended for the Settings of the “Latex”-Command.

E.g. the “\textbf”-Command has only one obligatory “Latex”-Field, where the Word “Situation” will be added. E.g. The Word “Situation” is inside the Command “\textbf” by Use of Braces.

```
The \textbf{Situation} was important.
```

[8] If you didn’t yet read the Chapter “BNF”, here an Explanation is due on two Notations, the “BNF” that describes the “Latex” itself and the “Latex”-Code that describes what happens to the Text. In BNF, the “Angle”-Brackets ⟨ and ⟩ signify that either the Word or Sentence within the Square- and Curly-Brackets is a **general Concept**. That is, when you see in “Latex” a Command, the Command will definitely won’t say “Command”, but will say something else, e.g. like **textbf** and be written as \textbf. Here you see an Example of a **“nonterminal”-Word**, the Word “Command”; a “nonterminal”-Word signifies a *Concept* and not an *actual Item*. For example you will never see in an Identity-Card the Word “Human”, but the Name of a Person. “Nonterminal”-Words are used in **Metalinguistics** to explain Concepts found in Languages. When a ProgrammingLanguage is developed, the Developer looks two Things: the Concept he tries to model with a ProgrammingLanguage, and the linguistic Aspects themselves that are defined in Terms of a **Metalanguage**. In Order for us to define the Concepts of “Latex” we use Metalinguistics, and in particular “nonterminal”-Words. See Chapter “BNF” for more Details if you have Time.

This displays: The **Situation** was important.

If a “Latex”-Command has optional and obligatory “Latex”-Fields, then the first Field is the optional “Latex”-Field, and the second Field is the obligatory “Latex”-Field.

The total Description of the “Latex”-Command is shown:

```
<Complete CommandForm>:=
   \<Commands>[<Options>]{<Parameters>}
```

Now I show two Examples of Commands.

E.g. The first Example of a Command contains a Name, an Option and a Description of the Option. Here the Command **“\definecolor”** (which is used to define a ColorName a ColorCoding and Values corresponding to the actual Color) lists three obligatory numeric Parameters (i.e. Numbers):

```
\definecolor{emerald}{rgb}{0.31, 0.78,
    0.47}
```

The second Example concerns the Command **\textbf** which is used to make the Text (the CharacterString “Hello”) “bold”-typefaced:

```
\textbf{Hello}
```

This obviously will print “Hello” as “**Hello**”.

Questions and Exercises

1. What is a “Latex”-Field?
2. By what Character is preceded a Command?
3. Is it possible when you see my Brother to hug him? Thanks in advance!
4. Write on Paper how you declare a Command.
5. What TerminatorCharacter is used for a “Latex”-Command?
6. What contains the optional “Latex”-Field of a Command?
7. What contains the obligatory “Latex”-Field of a Command?
8. Write on Paper the total Description of a “Latex”-Command.

36.3.3 Commands for “Latex”-Environment

A **“Latex Environment”-Command** AKA **“Environment”-Command** is an Area influenced by a Command, placed locally in a Document and affects only a specific Content. Almost every “Latex”-Command has a “Environment”-CommandForm. To declare a “Environment”-Command use the “\begin” and “\end” Commands together with the obligatory Fields that contain the CommandName.

E.g. The “Enviroment”-CommandForm affects everything inside the “begin”- and “end”-Commands.

```
\begin{<CommandName>}

\end{<CommandName>}
```

Between the “Environment”-Declaration you can put the Text or Commands or other “Environment”-Commands, the latter Scripting is referred to as “Nesting” of Commands.

E.g. The following “Environment”-Command describes the included Content as Blackface (AKA bold) [9]

```
\begin{bfseries}
   The Operation succeeded, the Patient
       perished.
\end{bfseries}
```

Which will result in:

The Operation succeeded, the Patient perished [10] **.**

[9] I am speaking about PrintingTerms where black Ink is attached to a PrintingType which is physically thicker than the normal PrintingTypes, e.g. Compare the Character “B” and the Character in Blackface “**B**”.

[10] This is a Newgreek Proverb on the Success of a bad Product or Process.

I can also use a nameless “Environment” to constraint Access and modify a particular Command. A nameless “Environment” is declared with two curly Braces and within it there are the Commands that are active or modified.

E.g. Inside this nameless “Environment”, the TextWidth is modified to 20.0 cm.

```
{\setlength{\textwidth}{20.0cm}
}
```

11

The Term “EnvironmentForm” can be found instead of “Latex”-Environment.

Questions and Exercises

1. What is a “Latex”-Environment?
2. How do you declare the “Latex”-Environment of the “figure”-Command?

36.3.3.1 Scope of Commands

The **Scope of Commands AKA CommandScope** concerns the Effect of Commands on Text and TextSettings, as well as **Shadowing of Commands** (e.g. hiding the Influence of Commands) in Favor of either other Commands or simple **CommandSuppression**. By using Shadowing, we can reduce the Possibility of Conflict between different Packages since we are restricting the Scope of *where* these Resources operate.

[11] The Term “Length” can be misinterpreted in “Latex”. A Letter or A4 Paper has one Side longer than the other, and the longer Side is the PageLength, while the smaller is the PageWidth. If I have the Paper in a PortraitView, then the PageWidth is parallel to the Surface and Direction that I write and the PageLength is the vertical to the Surface that I write. Now the “TextWidth” as a “Latex”-Command, is THE LENGTH of the TextLine, not the Width from Bottom to Top of each Character! Consequently, the “TextWidth” is equal or less than the PageWidth.

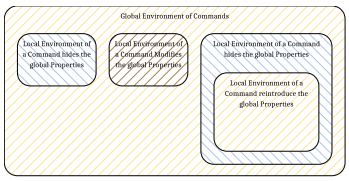

Global Environment of Commands
Local Environment of a Command hides the global Properties
local Environment of a Command Modifies the global Properties
Local Environment of a Command hides the global Properties
Local Environment of a Command reintroduce the global Properties

Figure 36.1: The Scopes of the “Latex”-Commands.

Remark 36.3.3.1. Consider that the Scope represents Areas where we can use the Effects of Commands or we can hide the Effects of Commands.

There are many Variations of CommandScope,the Variations should be considered as “Venn”-Diagrams where Inclusion, Exclusion, Intersection and Union between Properties is possible. If you don’t have a Clue what a “Venn”-Diagram is, does not matter, go directly to the Items, which are:

- The **global Scope**, which is the InfluenceArea of all Commands and concerns the default Operation of Commands.
- The **local Scope**, which is the InfluenceArea of a Command that bypasses its default Operation. The Bypass of the default Operation is done either by adding or changing to a Command its Operation in a local Environment.
- The **local Scope within a local Scope** where the default Operations can resume.

The following Diagram, 36.1 demonstrates the Scopes:

The CommandScope is can be arranged with the so called “Environments”.

36.3.3.2 Internals of DocumentIndentation

Indentation is defined as:

Def. 36.3.3.1*:* **Indentation (Publishing):** refers to the Process of inserting

TextSpace on left or right of a Paragraph, in Order to make the Paragraph visually and functionally appropriate.

Concerning "latex"-Editing, the Indentation is used to convey the CodeStructure to the "Latex"-Editor [12] . In Fact, Indentation has no Effect to the "End"-Product, but is used to make the "Latex"-Content easily readable and understandable by the "Latex"-Editor. You indent a TextDocument normally with the "Tab"-Key of the Keyboard. The "Tab"-Key was invented for the TypeWriter and remained in digital DocumentPreparation.

In most of the Cases the Indentation of a "Latex"-File will be flat, that is, no Indentation at all. In some Cases though, the Indentation will be present, for example, when you need to refer to an Object.

E.g. The following Code shows the Indentation inside a "Latex"-File on the "Figure"-EnvironmentCommand:

```
\begin{figure}
   \centering
   \includegraphics
   \caption
\end{figure}
```

Note: For reasons of your mental Hygiene, tune your TextEditor [13] into Use of Tabs that insert TextSpaces instead of the "Tab"-Character. Please use Tabs of 2 to 4 Characters but not more than that, otherwise you might loose vital written Space as well Overview.

The "Tab"-Symbol as a Code makes some Problems in ProgrammingDocuments and is normally deprecated, at least for the Software that I prepare for the super Villains that I work for.

[12] i.e. the Looser that codes Latex, not the Author! This a pretty SplitPersonality don't you think?

[13] A TextEditor is used to write Characters and only Characters. A SoftwareApplication for "Latex" might have its own TextEditor, but we avoid the similar Term **"Tex"-Editor** which is frequently used by novices, since is problematic to pronounce it distinctly.

Questions and Exercises

1. What is Indentation?
2. State What does Indentation conveys with respect to "Latex"-Editing?

36.4 "Latex"-Content-Structure

The **"Reader"- ContentStructure** is the Structure that the **"End"-Product** will have, that is, the Structure that the Reader will perceive (i.e Title, Preface, Chapters, Appendix, Pictures of the Playmates of the Year as they shower together etc.). This Structure is different from the **"Latex"-ContentStructure** which is the internal Structure of the ProgrammingMechanism that will produce the "End"-Document. Somehow exist a **Convergence** between the "Reader"-ContentStructure and the "Latex"-ContentStructure at some Point, in a Sense, that the **"Reader"-ContentStructure** mostly obeys the **"Latex"-ContentStructure**.

This is a difficult Point to make: this Convergence is about the Placement of Commands which precedes and influences the Content in a Sense that a *parallel structured Document* is superimposed on the *actual Document* that the Reader created.

Remark 36.4.0.1. Having your Ideas on Paper together with Diagrams and deducing a Structure of your Document is a very important Aspect of professional Writing! The TimePeriod where Tex was created didn't have professional "DocumentPreparation"-Software and consequently the Paradigm of Tex was created. Saying that, the Creativity of Paper is much more important than the TimeLoss you get by typing on a Computer your Text and at the same Time preparing the Document.

There are (at least) two “Tex”-Files that impose the “Latex”-ContentStructure and these are the **“Root”-Document** and the **“Style”-Document**.

Questions and Exercises

1. What is the “Reader”-ContentStructure?
2. What is the “Latex”-ContentStructure?
3. Which are the Computer-Files that impose the “Latex”-ContentStructure?

36.4.1 “Root”-File

I will now consider most of the internal Aspects of the “Root”-File (AKA “Base”-Document AKA “Root”-Document). The **“Root”-File** is the AdministrativePart of the “Latex”-Document in Terms of Structure and Style of the AuthorContent. Because of this Responsibility each DesignAspect of the “Latex”-ContentStructure will be addressed here. The Subjects under the “Root”-File that I will consider are:

- The HeaderCommentary
- The Templates for Documents
- The Resources for the “Root”-Document

Questions and Exercises What is the “Root”-File and what does contain?

36.4.1.1 “Root File”-Commentary

A ScriptCommentary inside a “Latex”-File is a metalinguistic Construct that tells something about the Coding itself, perhaps even about the DocumentSubject. Inside the “Root”-File should be a a special ScriptCommentary about the Creator of the Document. This Commentary is called in Programming **“Header”**, but to avoid Confusion in the TextProcessing I will use the Term “Root File”-HeaderCommentary. This should at least contain:

- Author’s Name
- Either Author’s or Company’s Address
- Title of File
- Purpose of File
- Date of FileInitiation
- Date of FileModification
- “Revision Control System”-Information
- ApplicationSoftware and its Version-Information concerning the “Latex”-Production (i.e. the “Latex”-Software and its Version. The ReaderContent has its own VersionNumber).

You can automate (find out yourself) this “Root File”-HeaderCommentary so that when you create a Document, this Information automatically appears together with current Date and “Revision”-ControlCode. Many Authors do not add this Information because they consider it redundant. However, every “self respected”-Master (or *Jester* in my Case), has some Backup or a “Revision”-ControlSystem that takes Care this Sort of Details. Therefore consider before any Project, the RevisionControl and the Backup (i.e. the Copy of your Work). It is easier than to have a girlfriend and probably more reliable than her.

Here is a “Root File”-HeaderCommentary placed in the “Root”-File [14] :

[14] Some Users might place a special Code enclosing this Information in each sub Document.

```
%---------------------------------------------
%Author:    Chris Neufelt
%Address:   Somewhere in Time
%Title:     Find the Title
%Purpose:   To find the Title for a Document
%Date:      11th April 2021
%Time:      07:43 (AM)
%Revision:  1.1
%Software:  TeXStudio 3.1.1 with TexLive 2020
%---------------------------------------------
```

Questions and Exercises

1. Write in Paper your own "Root-File"-Header-Commentary.
2. Find in Internet ProgrammingHeaders and study them.
3. Find in Internet funny Programming-Headers. Don't be afraid to comment even **critical Programming-Code** with funny Header. It will serve as a MemoryStab for the Reader and it will make his Work more pleasant.

36.4.1.2 "Root Document"-Classes

The **"Document"-Class** is the **"DocumentType"-Template** (Book, Journal, Article etc.) you intend to create. You should consider it as the **primary Template** for the Document-Development. A Concept behind Tex, was the Standardization of DocumentTypes, so that the Writer *-no Matter what he creates-* he will not divert his Effort from his "DocumentType"-Template [15] .

The Command:

```
\documentclass[<options>]{<parameters>}
```

is the first Command you need to put in a "Root"-File. In the ParameterSection you need to enter one of the Classes (i.e Templates) of a Document (written as they appear, lowercase):

- **article**
- **book**
- **letter**
- **manual**
- **slides**
- **report**

e.g. Create a Book by declaring the "Document"-Class called "book".

```
\documentclass{book}
```

The OptionsSection in the Command will be explained later.

Note: Many publishers have their own "Latex"-Templates available for Use once you get a Contract or PublicationPermit with them. These Templates are based on the "Document"-Classes mentioned and typically have their own "Latex"-Packages.

Questions and Exercises

1. What is the "Document"-Class?
2. How do you declare the "Document"-Class for an Article?

36.4.1.3 "Root Document"-Resources

The Functionality provided in a "Latex prepared"-Document is due to SoftwareResources that the "Latex"-Software has available to its Arsenal, that is, in the Installation of the "Latex"-SoftwareSystem.

A **"Root File"-Resource** is a small Code that performs among others the Editing and Structure of the Content. This Code is provided usually by "Tex"-programmers. A "Tex based"-Project keeps such needed Resources in ComputerFiles called **Packages**. Packages contain

[15] Speaking about Templates, before "Latex", I used Microsoft™Word™. Nice Product, but after **heavy** Use I reached the Point where the fine Settings for the Document could literally destroy the "End"-Product. Libre Office tried to solve some of the Maladies of Microsoft Word™, but has still a lot to do. The main Purpose of "Text"-ProcessingProducts and "Latex"-Products is actually pretty different and I described it elsewhere in this Book.

the Commands for “Tex”-Operations. In a “Tex”-Project the User will call specific Functionalities that otherwise are inaccessible by the “Tex”-System.

To include a Package (i.e. to invoke the Code from a Package, that is, perform a PackageCall), you enter it after the **“\documentclass”-Command**, in its own Text-Line, by using the “\usepackage”-Command:

```
<Include a Package>:=
   \usepackage{<package name>}
```

E.g. Include the Package “mathtools”.

```
\usepackage{mathtools}
```

Worth to note, that for very special Resources, a ScriptCommentary should appear after the Package, explaining what Operations we are targeting. E.g.

```
\usepackage{mathtools} % For the ``
     derived''-Sign
```

Some Notes about Packages are important:

1. The PackageSection should be after the “\documentclass”-Command, and will be typically the most frequent EditingSection of the “Latex”-Document. A “Revision”-ControlSystem is here a Must for the heavy Use of “Latex”.

2. As the Document will be heavier due to Packages added, consider to use “CommentaryPage”-Separator for Grouping the Packages according to their Functionality.

3. If the PackagesAmount used is large, then you can put PackageCalls in a specific ComputerFile that resides in the “Latex”-DocumentDirectory. In this Way, you have one Reference to a ComputerFile containing the Packages. The FileEnding for this file is **“sty”** for **“styles”**, and you don’t need to include this FileEnding in the Invocation.

4. Some Packages might raise a Conflict with each other. This is a continuously developing Situation that is your Responsibility to observe. An Update of the Version of Latex can even have horrendous Results and this is why we use ScriptCommentary of the Version of “Latex”. Typically a “Latex”-Editor should constrict the Scope of Commands in “environments”.

Questions and Exercises

1. What is a Package?
2. How you declare the Use of a Package “luatex”?
3. In which FileType you place the PackageDeclarations?
4. Why you should put ScriptCommentary on the Resources you use from a Package?

36.5 ReaderContent

The **ReaderContent** is the Information that arrives to the Reader, and contains the **Information (AKA Content)** and the **InformationStructure (AKA DocumentSections)** that divides properly the InformationBody into understandable Parts.

Remember:

$ReaderContent = Information + InformationStructure$

Each Part can contain other Parts: thus the InformationStructure is created by decomposing the Information into smaller Parts according to Hierarchy, Priority and Importance.

Questions and Exercises

1. What contains the ReaderContent?

2. What is the Purpose of Information-Structure?

36.5.1 Content

The Content is just the Text that the Document will convey. This is easily added in "Latex": after the **\documentclass**-Command and the **PackageDeclaration** you need to declare a "document"-Environment with an empty TextSpace for your Content:

```
\begin{document}

\end{document}
```

E.g. Adding Content to the Document:

```
\begin{document}
   Here comes the text
   that you want the
   reader to read.
\end{document}
```

However the Situation is still fluid. You can add any Text, but the Result will be only Text, like what a TextEditor with no logical Structure will convey. Still, we have already a Document with some obvious Content. Keep focused for more to come.

Questions and Exercises

1. How do you declare the "document"-Environment?
2. What do you enter inside the "document"-Environment?

36.5.2 DocumentSectioning

The DocumentSectioning provides the InformationStructure that Information needs to deliver to the Reader. The DocumentSectioning is done within the "document"-Environment by inserting the ContentParts inside their DocumentSections. Here you need to add to your "Root"-Document some Commentary about the Content.

This is not an "ad hoc"-Process though! you need to have a clear DocumentStructure on your Side, together with Calls to the "Tex"-Files that contain Parts and Sections of the ReaderContent. Here are the main DocumentSections needed to be added as Commentary:

1. Title and Author of the Document
2. Table of Contents (this will be generated, but is good to indicate that should be there)
3. All the Parts of the ReaderDocument defined by their **Headings**.

Having these Parts, you are ready to make possible your Document. Next I will show the Commands that implement these DocumentSections.

Questions and Exercises Which are the main DocumentSections that need to be considered?

36.5.2.1 Title and Author

A Document contains also its Title and the AuthorName. These are two Commands available, \title and \author. Their Commands are defined as:

```
<Declare a Title>:=
   \title{<DocumentTitle>}
```

```
<Declare an Author>:=
 \author{<Name of the
     DocumentCreator,
  usually the bald Guy that you
  used to bully in a Class long ago
  but now you have to tolerate
      since he
  has a Wife 20 years younger than
      him,
  a Sports-Car, he is rich and
  he is your Boss>}
```

In Addition, there is a Command for including the Title of the Document at the "End"-Product. This is:

```
\maketitle
```

These Commands are included in the Order mentioned.

E.g. Title and Author of Document

```
\title{Something that I wrote}
\author{Christopher Neufelt}
\maketitle
```

Questions and Exercises How do you declare Author and Title as well as including the Title of the Document?

36.5.2.2 Table of Contents

A **Table of Contents**, AKA **TOC** AKA **ContentsTable** lists the Headings (i.e. the Sections) of the Document by AppearanceOrder of the Headings. It can be configured to show only the most important HeadingLevels, i.e. can select particular Types of Headings to be displayed.

The ContentsTables, is added with the Statement:

```
<Declaration of TOC>:=
   \tableofcontents
```

This Statement is entered **after the "document"-Statement** for the Purpose of positioning the Table before the ReaderContent [16]

The Headings have DepthLevels (Chapter, Section, Subsection etc) and the TOC can be arranged to show only the most vital Headings by prioritizing the higher Headings. To add enumerated "Heading"-DepthLevels to the Document, just add before the Code which states that there will be a "Number of Levels deep"-HeadingContent:

```
<Settings of the TOC concerning the
     DepthLevel>:=
   \setcounter{tocdepth}{<Number>}
```

E.g. In the TOC shown, will appear Chapters, Sections, Subsections, Subsubsections and ParagraphSections for the "Book"-Class.

[16] But why? In Order for the Reader to get quickly an BookOverview and quickly access the ReaderContent. I am still traumatized by my SchoolBooks that had the TOC at the BookEnd.

```
\setcounter{tocdepth}{5}
\tableofcontents
```

In other Words, irrespective of the HeadingDepth that we have in a Document, we can have partial or full Heading appearing in the ContentsTable.

Note: The Compilation of the final Document is done twice, in order to generate the ContentsTable. The first Compilation creates the ReaderContent, while the second Compilation updates the ContentsTable.

36.5.2.2.1 Removing the visible Links on a ContentsTable You can use the "hyperref Package"-Command, "hypersetup", with Argument "hidelinks" to hide the Links on the ContentsTable.

E.g.

```
%This is in ''styles''-File:
\usepackage{hyperref}
...
%This is in the main DocumentFile.
\hypersetup{hidelinks}
\tableofcontents
```

Questions and Exercises

1. How do you declare the Depth of a ContentsTable?
2. How do you declare the Creation of a ContentsTable?
3. How do you remove the visible Links on ContentsTable?

36.5.2.3 Headings of DocumentClasses

The Headings (AKA Sections) are local Titles that divide the Document into Parts. They are used for Sectioning the ReaderContent and thus are perceived by the Reader. Here are the Sections of the "Document"-Classes concerning the most common Classes.

36.5.2.3.1 "Article"-ClassStructure

The Article-Class defines the following DocumentSections:

1. **\part{}**
2. **\section{}**
3. **\subsection{}**
4. **\subsubsection{}**
5. **\paragraph{}**
6. **\subparagraph{}**

36.5.2.3.2 "book"- and "report"-ClassStructure

The "book"- and "report"-Class defines the following DocumentSections:

1. **\part{}**
2. **\chapter{}**
3. **\section{}**
4. **\subsection{}**
5. **\subsubsection{}**
6. **\paragraph{}**
7. **\subparagraph{}**

36.5.2.3.3 "letter"-ClassStructure

In particular, the "letter"-Class defines the following DocumentSections:

1. **\address{}**
2. **\opening{}**
3. **\closing{}**
4. **\signature{}**

I am a little skeptic on "letter"-ClassStructure, but you must remember that during the Creation of Tex the Software for DocumentPreparation was in its Infancy.

36.5.2.4 Headings and their Enumeration

A Heading (AKA Section) can be preceded by a Number in Order to define the Part it refers as well as the PartLevel.

E.g. 1.1. How the Clara became a Witch

This helps the Reader to locate the main Information in a Document as well as the Details that he wish (or not) to skip [17] .

During the Creation of the "latex"-Document itself, the "Latex"-Editor will define the "Heading"-DepthLevels of his Document *before* he starts the Editing. This is a Work that might repeat during the "Latex"-Development.

To add to a Document the enumerated "Heading"-DepthLevels, just add to the Preamble or before the "document"-Command:

```
\setcounter{secnumdepth}{<Number>}
```

This states that there will be a "Number of Levels deep"-Enumeration on Headings. For only a Chapter use zero, 0, for Chapter and Sections use 1 etc.

Questions and Exercises How do you declare the HeadingsDepth of Chapter, Section and Subsection?

36.6 FontSize of Sections

The FontSize of Sections is based on the "\documentclass"-Settings, where the normalsize is defined. For a 10pt Font, the Sizes are shown.

The SectionSizes are shown in Figure 36.2.

In Comparison, the SectionSizes of Microsoft™Word™2013 is shown here in 36.3.

[17] How? By considering only the more important Sections in his Reading, such as the Chapters and Sections but not Subsections und Subsubsections.

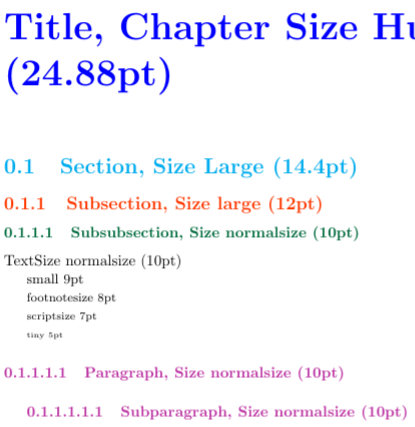


Figure 36.2: The most common SectionSizes in a Document. The Coloring of each Section corresponds to the ColoringScheme of this Document.

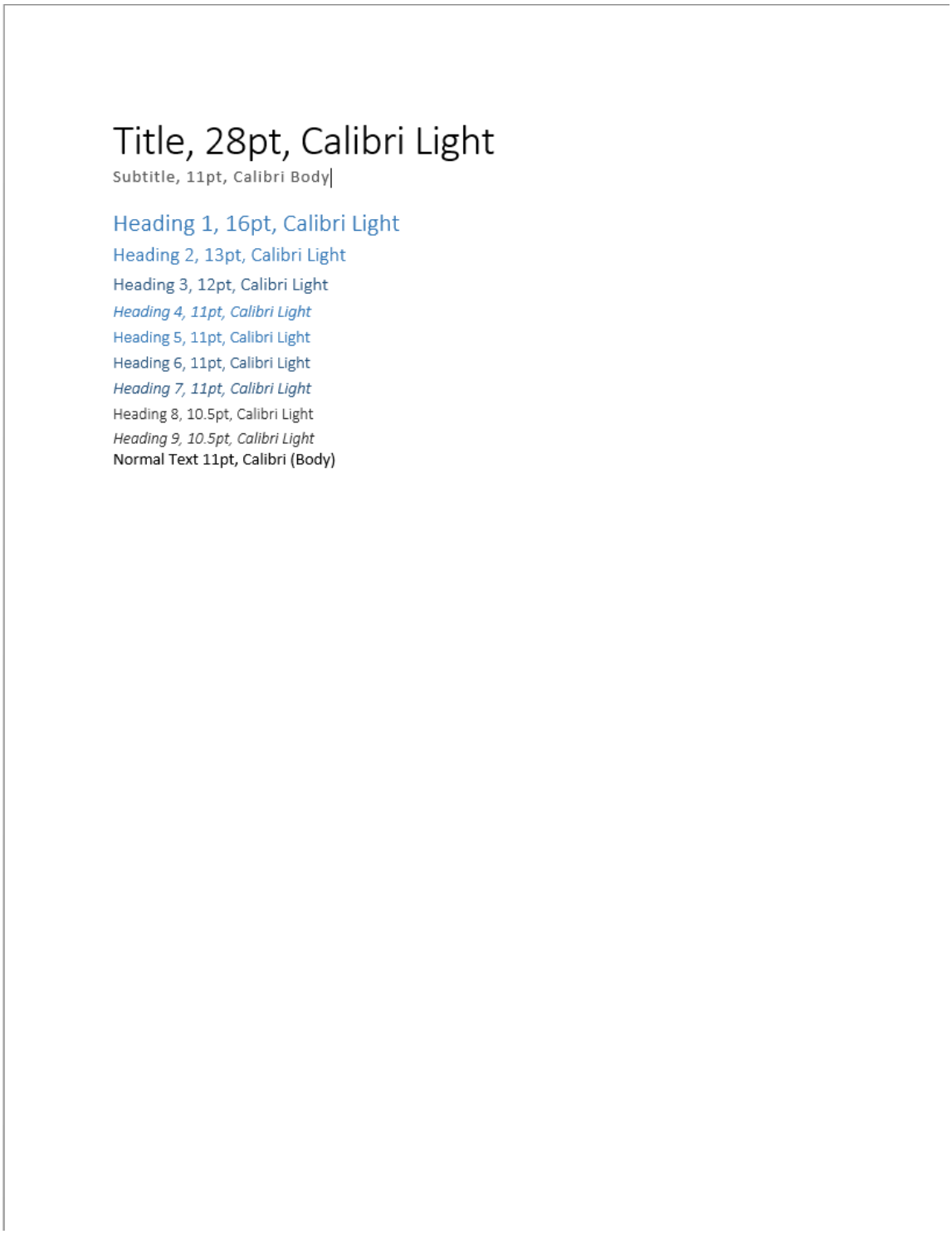

Title, 28pt, Calibri Light
Subtitle, 11pt, Calibri Body
Heading 1, 16pt, Calibri Light
Heading 2, 13pt, Calibri Light
Heading 3, 12pt, Calibri Light
Heading 4, 11pt, Calibri Light
Heading 5, 11pt, Calibri Light
Heading 6, 11pt, Calibri Light
Heading 7, 11pt, Calibri Light
Heading 8, 10.5pt, Calibri Light
Heading 9, 10.5pt, Calibri Light
Normal Text 11pt, Calibri (Body)

Figure 36.3: The most common SectionSizes in a Microsoft™Word™2013 Document. The Coloring of each Section corresponds to the ColoringScheme of Microsoft™.

36.6.0.0.1 Paragraph, Size normalsize (10pt)

36.6.0.0.1.1 Subparagraph, Size normalsize (10pt)

36.6.0.0.2 How to manage Headings Before you start a Document (any Document, this is a general Directive) write on Paper its Structure. The Structure contains:

1. **Title** corresponding to something Meaningful you want to create
2. **ChapterTitles** corresponding to the Analysis of the Title [18]
3. **SectionTitles** corresponding to the Analysis of each Chapter

After this Process, get to the "Latex"-Document and insert the Titles and Headings. That is. You can then start the CopyingProcess from your Notes.

Note: real Books start from writing on Paper and when **either all or most of the Writing is over**, only then the "Latex"-Processes start! Don't sacrifice your Productivity for Multitasking, since you loose on Creativity! [19] .

Questions and Exercises

1. Name the three things you need to write on Paper and then to the "Latex"-document before you start.
2. How real Books start and when "latex"-Editing comes?

[18] If you write Literature please give a Proper title that reflects the Titles of Headings. Titles like "The Fish that turned a Screwdriver" will not help the Headings of each Chapter if the Story concerns Love. Or Mayonnaise.

[19] This Pattern is similar to the Passage to become a Man or a Woman: first you take Care of yourself by proving yourself to the Work, and then you get to a Relationship: you have proven that you can take Care of yourself and now you can care for someone else.

36.6.0.1 Text

The Text is the ReaderContent that is needed to be embedded in the Document. Its the Information that the Reader reads and is directly associated with the Title of the Document. To enter Text, you can start writing the Text just after the Heading (Section) as usual.

```
\chapter{The House with the Bodies}
The House was a beautiful pre-50s
Villa with an adorable Garden at the
    front...
```

Questions and Exercises How do you add Text in a Document?

36.6.0.1.1 Generate a fake Text: Lorem ipsum Lorem Ipsum is a Text in Latin that is used to present printed Material so that the Examiner of the Printing has a Clue about his Layout [20] .

Def. 36.6.0.1*:* **Lorem Ipsum:** is a Text used as a Filler for demonstrating the Form of Text in a printed Medium.

To generate a fake Text for the Purpose of generating Content and testing "latex"-Editing as well as Layout, you should use the Text *Lorem ipsum* generated by the "lispum"-Command which is available by use of the "lipsum"-Package.

The "lipsum"-Command will generate 57 Paragraphs(!) but you can select a Range of them by using numeric optional Parameters.

E.g. Generate "Lorem Ipsum"-Text of the first 2 Paragraphs.

```
\usepackage{lipsum}
...
\lipsum[1-2] %Paragraphs 1 till 2
```

will display:

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae,

[20] If you don't have Lorem Ipsum, you can copy intersectional QueerTheories to put the Examiner in the Condition of Suicide. Since not many LayoutExperts exists outside, this is not an Option for protecting an endangered Species ☺.

felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Questions and Exercises

- How do you generate a fake Text for Testing?
- How do you select the TextRange for the fake Text?

36.7 Inclusion of File

To include a File use the `\input`-Command. The `\input`-Command can be anywhere inside the “tex”-File. It can refer to the “Preamble” or it can refer to any other File within the “Body”. The Command will also define a DirectoryStructure for Files found elsewhere, but if the Reference to a File does not exist, then the “tex”-Software will assume that the File resides in the current Directory of the Project.

E.g. In this Example the `\input`-Command refers to four Files and of course there is a fifth File that contains the Code shown.

```
\input{CN_DocumentTemplate}
\begin{document}
   \frontmatter
   \input{Title_MyLife}
   \mainmatter
   \input{Chapter1/Chapter1}
   \input{Chapter2/Chapter2}
   \backmatter
\ end{document}
```

A File can further have `\input`-Commands.

E.g.

```
\chapter{How it began}
\input{Section_01}
\input{Section_02}
\input{Section_03}
\input{Section_04}
```

36.8 Complete Example

The following Example demonstrates the Aspects of Latex that I discussed in this Chapter. This Example is the minimum that someone can display on his Capabilities concerning the “Latex”-DocumentPreparation.

The “Latex”-Software starts and you create three ComputerFiles. These are:

- Title
- Table of Contents
- ReaderContent

```
%***************************************
%Author: Neufelt Chris
%Date: 12 January 2012
%Subject: Lorem Ipsum Parts 1 to 4
%FileName: Document.tex
%***************************************
\documentclass{book}
\usepackage{lipsum}
\setcounter{tocdepth}{2}
\begin{document}
```

```
    \title{Lorem Ipsum}
    \author{Christopher Neufelt}
    \maketitle
    \tableofcontents
    \chapter{The ``Lipsum'' Parts 1 and 2}
    \lipsum[1-2] %Paragraphs 1 till 2
    \chapter{The ``Lipsum'' Parts 3 and 4}
    \lipsum[3-4] %Paragraphs 3 till 4
    \subsection{The ``Lipsum'' Parts 5 and
        6}
    \lipsum[6-6] %Paragraphs 3 till 4
\end{document}
\end{document}
```

Upon Compilation, the Book is created. While by Default, the Book produced is nice, the whole Idea of Tex is to produce a beautiful Book, by Application of Settings. The Rest of this Book shows how to do it.

The first Page contains the Title, 36.4:



Figure 36.4: The first Page of the Book is the TitlePage.

The third Page contains the Table of Contents, 36.5:

The fifth Page contains the first Chapter, 36.6:

The seventh Page contains the second Chapter, 36.7:

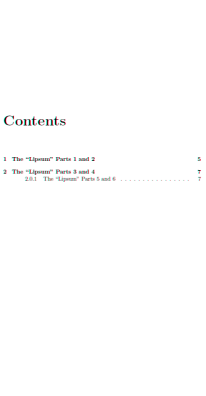
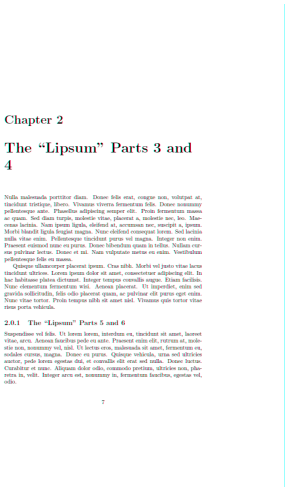


Figure 36.5: The third Page of the Book is the Table of Contents.



Figure 36.6: The first Chapter of the Book



Chapter 2

The “Lipsum” Parts 3 and 4

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

2.0.1 The “Lipsum” Parts 5 and 6

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et unuc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

7

Figure 36.7: The second Chapter of the Book.

Chapter 37

PageElements

Narrative

This Chapter investigates the various Elements that a Page is composed, as well as various descriptive Items. As before, I maintain my Effort to focus only to a very small Set of “Latex”-Commands.

37.1 Parts of Page

Let a Document of technical Nature and any of its Page containing DocumentObjects. The typical Objects and Issues encountered in TypeSetting are the following:

- PageCharacteristics
- ParagraphCharacteristics
- TextCharacteristics
- Special Items on the Page
- Color
- Tables
- Inserted Pages inside the Document from another Document as Pictures
- CodeListings
- Graphic Items
- Mathematical Expressions

Some of these Items are shown in the Figure provided, 37.1

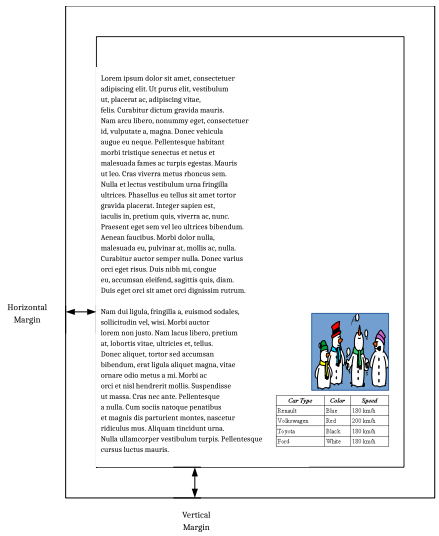


Figure 37.1: Some of the Elements of a Page, such as Margins, Paragraphs, Pictures and Tables.

37.2 PageCharacteristics

The **PageCharacteristics** are all these items that affect Text, Paragraph and the included Text in a Page.

Def. 37.2.0.1*:* **PageCharacteristics (Publishing):** is the Set of Controls that affect the Text on a Page and primarly concerns the Use of Space and its Configuration on Text.

Remark 37.2.0.1. The Term "Configuration" refers here to the Arrangement of Text within an Area of blanc Space.

37.2.1 The ParagraphSpace

Each Page has empty TextSpace where the Text needs to be allocated. Typically when we type on the Keyboard, this is done automatically in the "Latex"-Software, but sometimes there is the Need to define a Variation on this TextSpace. Before we consider these Variations, we must to define some Terms concerning this (imagined as Paper) TextSpace.

A TextLine is just an perceived Strip of Text, where Words are allocated to form Titles and Sentences. See Figure 37.2. By Definition:

Def. 37.2.1.1*:* **TextLine AKA Line:** is a region of (paper) TextSpace representing a horizontal Division of TextSpace, where Words are allocated, usually in Form of a Title, Word or Sentence.

Inside the Page there is available Area to place TextLines and Paragraphs. This Area is called "TextSpace". This is defined as:

Def. 37.2.1.2*:* **TextSpace (Publishing):** is the Area within a Page where the Text appears.

Text can be everywhere but by Default, the Text has its Location primarily inside a Paragraph which might be a TextLine or many TextLines. A TextSpace consists

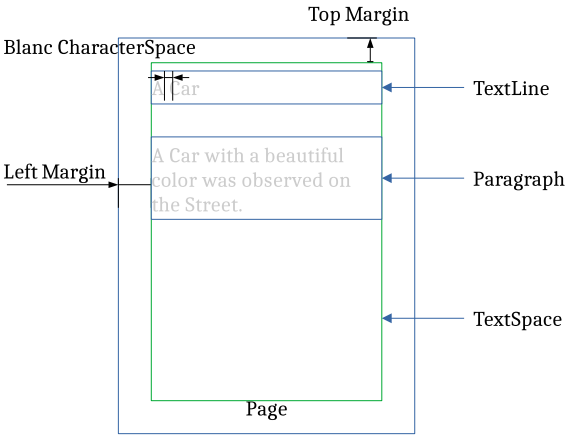


Figure 37.2: The most common PageCharacteristics. See Text.

of one or more Paragraphs and a Paragraph consists of one or more TextLines. A TextLine consists of one or more Words. A Word consists of one or more Characters.

A Paragraph appears more or less like a Rectangle of TextLines. See Figure 37.2.

A Paragraph is separated by the Edge of the Paper by Space, called "Margin".

Def. 37.2.1.3*:* **Margin:** is a TextSpace between the TextLine and the PaperEdge (AKA PageBoundary AKA PageBorder) of the Page

The Margin denotes the primary TextSpace between the Page and the Paragraph, and usually applies to all the Document. Each DocumentStyle has its own MarginLength on Top, Bottom, Left and Right of the Paragraph.

Within each Paragraph there are Words which are separated by Space of one Character, the blank CharacterSpace.

Def. 37.2.1.4*:* **Blank CharacterSpace AKA Blank AKA Space:** is a TextSpace of usually one CharacterSize which separates two Characters, usually the Characters are the End- and the BeginningCharacters of two Words.

E.g. The Sentence "The Morning" has

a CharacterSpace between the Character 'e' and the Character 'M'.

Worth to know that depending on the DocumentSettings, the blank CharacterSpace can be elastic, i.e. it can span in a varied Length according to the JustificationSetting and the complete Compilation of the Document.

Associated with the Paragraph is the Indent, the Space between the Margin and the Text and typically is more than one CharacterSpace. A Text which bounds with the Margin can be shifted right by Use of Indent. To make Indent you can either Use a DocumentSoftware or the "Tab"-Key [1] .

Def. 37.2.1.5*:* **Indent AKA Tabs:** is a fixed Space which forces a Text to be displaced right with respect to the previous Line.

E.g. Under the linguistic Article "The", there is an Indent wide as three Characters in the next Listing.

```
The Candidate spoke in the Conference
   and consequently the Audience was
   amazed from his scientific Achiev-
   ement of the first solar operated
   Dong.
```

The Process of adding Indent, is called "Indentation".

Def. 37.2.1.6*:* **Indentation gr. Παραχώρησις, ἡ:** is the Process of adding fixed Space along a TextLine where the Text will be placed.

A Paragraph typically will have only two Spaces indented when is the second Paragraph in a Section, that is, the Indent is automatically added. However the Editor can apply Indentation on a complete Paragraph.

Sometimes in Text, we want to make a Table just to place some Data and using as Separation the Space. This Process is called "Tabulation". In the Times of TypeWriters, the Tabulation was done by writing Words and Data and then using the "Tab"-Key to separate them. You can still use "Tab" but it might not recognized by any DocumentSoftware, not at least in the Way you thought.

Def. 37.2.1.7*:* **Tabulation:** is the Process of adding fixed TextSpace within a Sequence of Words, in order to separate their Meaning

Tabulation can be used for the creation of nongraphic Tables.

E.g. I have a Tabulation of three Columns and three Rows [2] :

```
Number   Name      Price
1        Shirt     $40
2        Trouser   $60
```

Within a Page the Paragraphs might be enumerated. The ParagraphEnumeration is typically accompanied by the Silcrow §AKA SectionSign. Another Symbol that you must know is the ParagraphSign AKA Pilcrow ¶, which is used for denoting the End of TextLine.

Finally another PageCharacteristic is the so called "Float". A "Float" is any Object, related to the ReaderContent, that can appear in different Positions of the final Document, due to either a CompilationSetting or a Setting intended by the "Latex"-Editor. By Definition:

Def. 37.2.1.8*:* **Floating Object or "Float" (Publishing):** is a Figure or Table or TextBox that can be relocated by the System of TypeSetting in another DocumentPart in Accordance to the LayoutRules of the DocumentTemplate.

37.3 Adding a blank Page

To add a blank Page it seems you can use the command "\newpage". While this in-

[1] Note for neurodivergent People: Confusion of "intend" with "indent".

[2] This Listing was produced in Terms of a TextEditor or a Typewriter. You should not use it in Latex since the Tabulation is done by other Means, namely Tables, mentioned later in this Document.

fers to nicely model such a Demand, in Reality it does not create a new Page but instead breaks the Page, i.e. it fills it with Blanks, and performs a PageBreak.

To actually create a new Page there are three Commands:

```
\mbox{}
\thispagestyle{empty}
\newpage
```

The "\mbox"-Command will create an empty TextBox without any Border. The Command "\thispagestyle" will not apply to the current Page any Style, and finally the "newpage" will break the current Page by applying the TextBox and PageStyle. Such a Construction can be used directly after the "frontmatter"-Command to create a blank Page. Indeed this is a simple Way to create a blank Page where you can add a BackgroundPicture with a Title, like in this Book.

37.3.1 PageHeader and PageFooter

At the Top and Button of a Page can be included additional Information serving as a Reminder to the Reader. This Information is allocated to the **PageHeader** and **PageFooter**. These Terms are defined as:

Def. 37.3.1.1*:* **PageHeader:** is the PagePart at its Top where typically the DocumentTitle and the SectionTitle appears.

Def. 37.3.1.2*:* **PageFooter:** is the PagePart at its Bottom where typically the PageNumber appears.

A PageHeader and a PageFooter can include customized Information. Examples of this can be Proverbs (found in Almanacs!) or Calculations (found in Manuals).

A Page might have none, one or both of the Items mentioned. Using the "\pagestyle"-Command directly after the "\documentclass"-Command you can enter three Options:

- **empty**: Both PageHeader and PageFooter are empty
- **plain**: PageNumbers set down in the PageMiddle
- **headings**: PageNumber and ChapterHeader appear in the PageHeader.

```
\documentclass{Book}
\pagestyle{headings}
\begin{document}
...
\end{document}
```

37.4 PageNumbering

The PageNumbering is at first View something easy: you add the Command and you get Numbers. Life is never easy, and the Numbering has different Coordination with respect to the Document. Typically, in an Article you can use the NumberingCommand from the Beginning; but in a Book you might have the first Page numberless, then the Pages until the first Chapter with Latin Numerals, and the Pages from the first Chapter with normal Numerals. Perhaps if you are writing a Manual you might also need to reset the Count.

The PageNumbering is done with the "\pagenumbering"-Command. This Command has as Arguments typically "arabic" for the normal Numerals and "Roman" for the Latin Numerals (among other Arguments, find out). The PageNumbers appear typically after the TitlePage. Consequently the TitlePage is not Included in the Numbering.

```
\begin{document}
%In this TextLine, the
%"\pagenumbering{Roman}"-Command
%will be allocated
%before the Table of Contents, typically
%after the "\documentclass"-Command.
%Directly after the "\chapter"-Command,
    follows the
%PageNumbering in normal Numerals
\pagenumbering{Roman}
\tableofcontents
\pagenumbering{arabic}
\chapter{The Solution of algebraic
    Equations}
...
```

```
\chapter{The Solution to end the Suicides
      of Mathematicians}
\pagenumbering{arabic} %Here restart the
      Count
\end{document}
```

37.5 Paragraphs

A Paragraph is a short TextPiece that denotes a self containing StoryPart. By Definition:

Def. 37.5.0.1*:* **Paragraph:** is a self-contained Entity of Information and is a multiple of Sentences.

A Paragraph consists of at least three Sentences. *A Dialog is not a Paragraph* [3] .

There are four Ways to start a Paragraph:

1. Directly after a declared Section E.g. directly after "\subsubsection"-Command [4]

```
\section{The new Car}
The new Car is a model or...
```

2. Having an empty TextLine between two written TextLines. E.g.

```
The new Car is a Model or...

Gill talk to Tommy about the Car
```

3. Using the "TextLine"-BreakingSequence \\E.g.

```
The new Car is a Model or...\\
Gill talk to Tommy about the Car
```

4. Using the "\newline"-command. E.g.

```
The new Car is a Model or...
\newline
Gill talk to Tommy about the Car...
```

[3] [Alred]: A Paragraph performs three Functions: (1) It develops the Unit of Thought stated in the topic Sentence; (2) it provides a logical Break in the Material; and (3) it creates a visual Break on the Page, which signals a new Topic.

[4] Note: there is a Heading for independent Paragraph within a text. The Heading is called **\Paragraph**

Questions and Exercises

Create a heading and experiment with Paragraphs of Lorem Ipsum the following:

1. Create a heading and after it insert the Paragraph
2. After the Paragraph 1 use an empty line and below the empty line use Paragraph 2
3. Use two backslashes to enter below the Paragraph 2 the Paragraph 3
4. Use the newline-command to enter Paragraph 4 after Paragraph 3.

Note: The horizontal Indent after the first Paragraph and for every next Paragraph within a Header, denotes a BulletPoint referring to a Paragraph, not a Sentence. When we use independent Sentences as Part of the OptionsNarration, then we use BulletPoints as Part of the Itemization (see later).

37.5.1 Justification

Justification is an AlignmentProcess affecting the Paragraph with the Purpose to make the Paragraph visually sided by the Margin. Typically as Operation is done with respect to left, right Margin or centered on Page or covering all the TextSpace until the Bounds of Margins. By Definition:

Def. 37.5.1.1*:* **Justification (Publishing):** is the ParagraphAlignment with respect to the Margins and the TextSpace.

Justification is done by default to cover all the TextSpace of a TextLine. However someone can add EnvironmentForms or DeclarationForms for the Justification.

A Term that is used in Justification is "flush"(Colonies) or "range"(UK). This simple means "align".

The EnvironmentForm uses the "flushleft" or "flushright" to align the Text left or right. The EnvironmentForm "center" aligns the Text on the Center of the TextSpace.

The DeclarationForm uses “\raggedleft”, “\raggedright”, and “\centering” perform Alignment inside an Environment with a Paragraph.

E.g. Here the DeclarationForms are used. Notice that one Command is nested inside another Command, where upon the End of its Effect, the Command “raggedright” will resume its Effect.

```
{\raggedright The Door was open.\\
   {\raggedleft I came to see him.\\}
   He was behind the Door.\\}
```

This displays:

The Door was open.

I came to see him.

He was behind the Door.

37.5.2 Spatial Properties of Paragraphs

Paragraphs are related to each other regarding the TextSpace they share. There are two Spaces that are considered, the SeparationSpace between two Paragraphs where one follows the other, and the SeparationSpace between the Paragraph and the Margins. The former is also known as “InterparagraphSpace” [5] .

The Commands “\parskip” amd “\parindent” are used for SeparationSpaces regarded the Paragraphs and Paragraphs with respect to Indentation from Margins.

You can either affect these Commands globally or locally. In any case, you can set any of them with Indent or ParagraphSeparation. Their Form before Use is:

```
\setlength{\parindent}{10ex}
\setlength{\parskip}{10ex}
```

E.g. In the Text that follows three Paragraphs have varied Indentations and Separations. The Code that was used is shown, but for saving Space, I partially include the Paragraphs.

```
{\setlength{\parindent}{10ex} Besides
     these troops...
{\setlength{\parskip}{5ex}\setlength{\
     parindent}{15ex}The difference
     between...}
{\setlength{\parskip}{2ex}Difficulties
     first arose about calling in the
     reserves...}}
```

This displays:

Besides these troops, there was a reserve corps of about 35,000 men, chiefly at Chalons. It must be remembered, however, that the French numbers were increasing daily, owing to the constant influx of the reserves, and at the commencement of August the strength may be put down at from 260 to 270,000 men.

The difference between the two systems of concentration is strikingly apparent. Each German army corps, completely furnished with men, horses and equipment, in its own local district, was forwarded to the front an effective unit of the army of which it was to compose a part. On the other hand, the French corps were actually mobilized on the frontier.

Difficulties first arose about calling in the reserves, afterwards in their transport and equipment, and the events of each succeeding day accumulated evidence as to the state of insufficient preparation and the other evils inherent in the French system.

Worth to know that these ParagraphSeparations are actually elastic in their Length, what is known as RubberLengths. Consequently they will adjust based on our Requirements and the Strategies and Tactics we use in our Document. A small Caution here: that “Latex” gives you the Responsibility to make a Document as you would like, does not mean that you can fuck it with absurd Requirements! The less the DocumentPreparation is loaded with Commands, any Commands that is, the less will be unstable.

An Alternative to these ParagraphSpaces you can use the Commands “\bigskip” “\medskip” “\smallskip”, after each Paragraph, where the SpaceSize is proportional to the TextSize. Another Alternative are the Commands

[5] For “Friends”, Samantha ☺.

“\bigbreak” “\medbreak” “\smallbreak” but they also suggest the PageBreaks to the “Latex”-Software.

E.g. Comparing the Sizes of InterparagraphSpace.

```
I did this.
\bigskip

You did this.
\medskip

He did this.
\smallskip

She did this.
```

Which displays:
I did this.

You did this.

He did this.

She did this.

37.5.3 Space inside a TextLine

You can add Space inside a TextLine. This Space is not populated by the “ASCII”-Character “Space”, but instead is an Area empty of any Character [6] .

There are two ways to add Space inside a TextLine:

- You add a varied Space that will adjust to the Words founds in the TextLine.
- You add a fixed or an elastic Space that will set the Words accordingly.

To add a varied Space inside a TextLine use the “\hfill”-Command.

E.g.

```
"Those Colors \hfill are simple."
```

“Those Colors are simple.”

To add a fixed Space inside a TextLine use the “\hspace”-Command.

E.g.

```
"Those Colors \hspace{2cm}fill are simple
    ."
```

“Those Colors fill are simple.”

There are much more to say about both Spaces! My Purpose here to show the Existence of these Controls and not much Details.

37.6 Modes of “Latex”-Processing

The “Latex”-DocumentPreparation is a digital ComputingProcess that affects the Document in different Ways based on Modes of Operation on Text.

As we know there are three major Views of the Document, one concerns the TextEditing (Words, Paragraphs, Headings, Titles etc.) the second concerns the ArtifactEditing (Pictures, Tables etc.) and the third concerns the mathematical Editing (Formulas, mathematical Expressions, etc.). On the Top of these Views, which actually concern of how the Author of a Document observes his Document, there are two Divisions of viewing the Document in Terms of “Latex”-Editing: these Views concern the Processing of Text and the Processing of mathematical Content.

According to these two Views, the Creator of Tex and later the Creator of Latex considered the Document to be operated into three different Modes according to its Content. The three Modes are:

- The vertical Mode, concerning TextProcessing from the Subview of Text on Pages.
- The horizontal Mode, concerning TextProcessing from the Subview of Text on Paragraphs.

[6] Technically Speaking, in the “Tex”-Technology, the Paradigm is that there is a Hierarchy of Rectangles, called “Boxes”, where any graphical Object can enter and displayed. This has the Benefit that every possible Combination of 2D Graphics is available, since the “Boxes” can contain Graphics of any Kind. It has the Hazard that the displayed Text is not textually continuous (i.e. Word after Word) but graphically continuous (i.e. Graphic after Graphic).

- The MathMode, concerning the Processing of mathematical Content from the Subview of InlineFormulas and independent Formulas.

The Modes of Operation affect not only the ReaderContent, but also the Concordance between Commands and their proper Deployment in the appropriate Mode; consequently the ErrorSystem of "Latex"-Software will be affected as well as the "End"-Result. **This is not a Thing to mess up.**

For a complete Discussion please refer to [latexref.xyz] [7]

The **vertical Mode** is divided into **vertical Mode** and **internal vertical Mode**, with the vertical Mode affecting the PageBreaks while the internal vertical Mode affecting the vertical Boxes (more on them later).

The **horizontal Mode** is divided into **ParagraphMode** and **LR-Mode**. The ParagraphMode breaks the Text into TextLines and indirectly affects the vertical Mode on PageBreaks. The LR-Mode affects the horizontal Boxes (more on them later) and considers the Text as an endless TextLine.

The **MathMode** is divided into **MathMode** and **display MathMode**. The MathMode inserts mathematical Contents into TextLines (i.e. it produces *inline* Artifacts) while the display MathMode inserts independent mathematical Contents more or less as independent Paragraphs or Figures.

The Processing of a ComputerFile is done in most "digital Computer"-Technologies per "Bit"-Basis until ControlCodes and ReaderContent is assembled, i.e. one "Bit" after the other is read, 8 "Bits" are assembled into one "Byte", and then the Bytes are assembled according to the FileType into ControlCodes and ContentCodes. In "Latex"-DocumentPreparation the Encountering of ControlCodes and ContentCodes affects the OperationModes, in the Sense that the Software reads the Document and shifts its Attention and Processing to different OperationModes according to the TextContent, e.g. The Document is read and processed in vertical Mode, then perhaps horizontal Mode, then shifts into perhaps mathematical Mode etc.

[7] [latexref.xyz]: https://latexref.xyz . Latex2e: An unofficial reference manual. January 2022]

Chapter 38

Internal Elements

Narrative

In this Chapter I will show all the small Participants in a Page, excluding mathematical Formulas, Figures, technical Drawings and Tables. These small Participants **I call them** "**internal Elements**".

The internal Elements are Boxes, Lists, national and commercial CharacterSets, Footnotes and Color, to mention a few.

38.1 Boxes

We can have inside a Paragraph or a Page a Box with Text. This is simple called "Box" and is defined as:

Def. 38.1.0.1*:* **Box:** is a rectangular and unbreakable TextContainer that behaves as an Entity that can be spatially displaced inside a Page.

The Adjective "unbreakable" denotes that the "Box" cannot be broken to smaller Parts.

There are three BoxTypes:

- The LR-Box: is a "Box" that can contain Text inside a Paragraph or as a Paragraph on its own and cannot be broken as TextLines.
- The ParagraphBox: is a "Box" that contains Paragraphs of Text.
- The RuleBox: is a "Box" uses as a Ruler, mainly for TextSeparation.

38.1.1 LR-Boxes

An LR-Box is used to create on a TextLine an Area where Text is allocated. There are two Types of LRBox, the mbox and the fbox, with the fbox adding a Frame around the Text, such as:

"I met Gina, AdultActress of the Year."

While probably you'll never meet Gina, the LR-Boxes have also additional Variations, the "makebox" and "framebox" that allow different Justification and TextWidth.

```
<Frameless Box>:=
   \mbox{<Text>}

<Frameless Box with TextWidth and Justification>:=
   \makebox[<TextWidth>][<Justification>]{<Text>}

<Framed Box>:=
   \fbox{<Text>}

<Framed Box with TextWidth and Justification>:=
   \framebox[<TextWidth>][<Justification>]{{<Text>}

Where

<Justification>:= c|l|r|s

Where

c:=Centered (Default)

l:=Left

r:=Right

s:=Stretched along the TextWidth
```

E.g.The default TextWidth and the arranged TextWidth of 1cm with left Justification is here:

```
\fbox{I met Gina, AdultActress of the
     Year.}

\framebox[3cm][l]{I met Gina AdultActress
      of the Year.}
```

which displays:

I met Gina, AdultActress of the Year.

I met Gina, AdultActress of the Year.

38.1.2 ParagraphBoxes

A ParagraphBox accommodates a bounded Paragraph which rests on the BaseLine of the TextLine. By Definition:

Def. 38.1.2.1*:* **ParagraphBox AKA vertical Box:** is a bounded Area of specified "TextLine"-Width which encloses a Paragraph and rests the Paragraph on the BaseLine of the TextLine.

Bearing this in Mind, there are two Options to make this possible:

- The "parbox"-Command. Limited in Editing but very sufficient for ground Work.
- The "minipage"-Environment. This is the most extended Version of ParagraphBox.

Multiple ParagraphBoxes can be separated by TextSpace to create a column-like ParagraphStructure. The Space can be created by "hfill"-Command.

E.g.

```
<Paragraph-Box1> <hfill>
<Paragraph-Box2> <hfill>...
<Paragraph-BoxN> <hfill>
```

However multiple Paragraph-Boxes do not work well in a predefined Column-Structure of a Document since they must constraint themselves to the ColumnSize, that is, they must be much less than the TextWidth of Column.

The "parbox"-Command has the form:

```
\parbox[<Position>]{<TextWidth>}{<Text>}
```

where

```
<Position>::=<No Argument>|<b>|<t>
<b>::=Match with the bottom Baseline of
     Text
<t>::=Match with the top Baseline of Text
<No Argument>::= Here the Option is
     avoided
   and the Paragraph appears in the
       Middle.
```

Similarly to Arguments, the "minipage"-Environment has the Form:

```
\begin{minipage}[<Position>]{<Text-Width
    >}
   {<Text>}
\end{minipage}
```

To create a two Paragraph-Boxes of Width 2cm each in this Document use the described Code:

```
\parbox{2cm}{PROPOSITION LXII: To determine
   the Motions of two Bodies which attract
   each other with Forces reciprocally
   proportional to the Squares of the Distance
   between them, and are let fall
   from given Places [Newton, Book 1 Section XI].}

\hfill

\parbox{2cm}{Proposition LXIV: Supposing Forces
   with which Bodies mutually attract each other
   to increase in a simple Ratio of their
   distances from the Centres; it is required
   to find the Motions of several Bodies among
   themselves [Newton, Book 1 Section XI].}
```

This will give:

PROPOSITION LXII: To determine the Motions of two Bodies which attract each other with Forces reciprocally proportional to the Squares of the Distance between them, and are let fall from given Places [Newton, Book 1 Section XI].

Proposition LXIV: Supposing Forces with which Bodies mutually attract each other to increase in a simple Ratio of their Distances from the Centres; it is required to find the Motions of several Bodies among themselves [Newton, Book 1 Section XI].

Note that the Term "PROPOSITION" was not cut from its Length if it is capitalized.

Beyond isolating a Paragraph, the ParagraphBox is used in TableDesign to enclose large Text into one Cell of the Table.

38.2 List of Items (Bullets), Descriptions and Numbering

38.2.1 List of Items (Bullets)

To create Lists of Items use the "itemize"-Enviroment. It has the Form:

```
\begin{itemize}
   <ListOptions>
   \item <Option> [\item <Option>]
\end{itemize}
```

E.g. A List of the first three *ordinal Values*:

```
\begin{itemize}
   \item First
   \item Second
   \item Third
\end{itemize}
```

Which is displayed as:

- First
- Second
- Third

38.2.1.1 Changing the "Bullet"-Symbol

You can also change the Bullet symbol if before the Backslash of the begin{itemize} you write:

```
\renewcommand{\labelitem}{$<Symbol>$}

Where

<Symbol>:=\cdot|\circ|\diamond|\ast|\
    bullet
```

which represent:
· , ○ ◇ , ∗.
E.g.

```
\begin{itemize}
   \renewcommand{\labelitemi}{$\diamond$}
   \item First
   \item Second
   \item Third
\end{itemize}
```

which displays:

◇ First

◇ Second

◇ Third

The Command "\labelitemi" is used to display the the Label of the Item. Since the Labels are mathematical Symbols in Itemization, the Presence of "Dollar"-Signs signifies that the Labels will be treated as mathematical Signs.

38.2.2 Enumerated Lists

An enumerated List is one that each ListItem has an Identifier, i.e. a Number, a Letter or a Symbol to assist its Enumeration.

Inside your Document-Content you declare the "enumerate"-Environment.

```
<Enumerated List>:=
   \begin{enumerate}
      <ListOptions>
      \item <Text> [\item <Option>]
   \end{enumerate}
```

Where

```
<ListOptions>:=
   \renewcommand{\labelenumi}{<Label>}

Where

<Label>:=\Alph|\arabic|\Roman among
     others
```

E.g. An enumerated List of *cardinal Numbers*:

```
   \begin{enumerate}
      \item One
      \item Two
      \item Three
   \end{enumerate}
```

which results to:

1. One
2. Two
3. Three

E.g. An enumerated List of *Roman Numbers*:

```
\begin{enumerate}
   \renewcommand{\labelenumi}{\Roman}
   \item One
   \item Two
   \item Three
\end{enumerate}
```

which results to:

I One

II Two

III Three

The Command "\labelenumi" is used to display the Label of the Item. The "enumi" inside the "\Roman", is a Counter for displaying Values, in particular for the first Level of Deepness. An Alternative is to use

I

for Roman Characters after the "enumerate" command.

38.2.3 Descriptions

Sometimes you might need a Description-Sentence followed by the Item of a List. You can attain this by using the the "description"-Environment:

```
\begin{description}
   \item[BlaBla] Said the Speaker
   \item[BluBlu] Said the Man
\end{description}
```

This will produce the Following:

BlaBla Said the Speaker

BluBlu Said the Man

38.2.4 Nesting of lists

You can nest one List on another by using repeated Statements as such:

```
\begin{description}
   \item[BlaBla] Said the Speaker
   \begin{enumerate}[I]
      \item First
      \item Second
      \item Third
   \end{enumerate}
   \item[BluBlu] Said the Man
\end{description}
```

which leads to the nested list:

BlaBla Said the Speaker

I First

II Second

III Third

BluBlu Said the Man

The following Code tests the EnumerationSequence in Latex according to Levels:

```
\begin{enumerate}
   \item First Level
   \begin{enumerate}
      \item Second Level
      \begin{enumerate}
         \item Third Level
         \begin{enumerate}
            \item Fourth Level
            \begin{enumerate}
               \item Fifth Level
               \begin{enumerate}
                  \item Sixth Level
               \end{enumerate}
            \end{enumerate}
         \end{enumerate}
      \end{enumerate}
   \end{enumerate}
\end{enumerate}
```

Which demonstrates:

1. First Level
   (a) Second Level
      i. Third Level
         A. Fourth Level
            A. Fifth Level
               A. Sixth Level

In Microsoft Office 2003 the Default was Number, small Letter, Latin Number then repeat the same Sequence (NLN). In Latex is Number, small Letter, Latin Number and then each further Level with large Letter.

38.3 International writing

Initially the "Latex"-TypeSetting was designed for the "English speaking"-World, and gradually expanded to other Languages. Concerning TextDocuments, remember that when you are using a TextProcessor, you should save the TextDocument as Unicode in order to have Access to other Languages as English.

Then the “Latex”-Software takes care the Detail of Encodings to other Languages.

The **“\babel”-Package** makes possible the Use of other Languages. The Preamble for this is:

```
\usepackage[<LanguageName>]{\babel}
```

Once the Document is loaded, you can start to enter the foreign Text.

You can also enter more than one Language, just use a String of Languages separated by Commas; notice that the default Language is the last one, that is the one at the end of the String. You can activate any specific Language in the String by using the “\foreignlanguage”-Command:

```
<Short Text in foreign Language>
   \foreignlanguage{<LanguageName>}
      {<ReaderContent>}
```

or the “otherlanguage”-Environment, i.e.

```
\begin{otherlanguage}{<LanguageName>}
   <ReaderContent>
\ end{otherlanguage}
```

E.g. We have a Document consisting of two Languages, Greek (“Latex” uses by Default the Ionian Font as the “New Greek”-Language) and English, with the Greek Language selected with accented Attributes and the main Language of the Document is selected per Default the English:

```
\usepackage[greek, english]{babel}
\languageattribute{greek}{polutoniko}
```

Then after a Time, the Greek Language is selected and written:

```
\foreignlanguage{greek}{<Greek ReaderText
    >}
```

E.g. Greek and English Text, the Greek Text uses ancient Greek AccentSpecification.

```
The Greek Student said:
\foreignlanguage{greek}{Αἰδίου θρίξ, ναῦν ἑλκειν}
and went away.
```

This displays:

The Greek Student said: Αἰδίου θρίξ, ναῦν ἑλκειν and went away [1] .

[1] This Sentence does not exists in ancient Greek, some neo Greek Students made it. It attests a Metaphor on the (sexual) Attachment of Men to Women: a single Hair of mons pubis can pull a Ship. Seeing my Friends begging beautiful Women, I can attest that this Statement is completely true.

38.4 Special Characters

Because the “Latex”-Editing makes heavy Use of some Symbols, the Writer can add the same Symbols in his Text by adding a Backslash in front of the Symbols. That is for the Character-Symbols:

~ { } _ \# % & ^

we enter to the Tex-Document:

```
\~ \ \{ \} \_ \textbackslash \# \% \&
    \^{}
```

Notice that the Signal for “Tilde” is followed by two Braces.

38.4.0.1 Greek Characters

These Characters are defined for mathematical Expressions, not for the Greek Language and represent the Ionian Alphabet [2] . See 38.1 next.

Note that the names for the Characters follow the ancient Pronunciation and not the New Greek Pronunciation. E.g In New Greek χ is pronounced as “he” while in Greek is pronounced as “khe”. The “e” when we transcribe ancient Greek Text in English Language is unfortunate written as “i”. Please don’t ever comment with a new Greek Person on Pronunciation. You will loose Time and you will gain an Enemy.

38.5 Footnotes

A FootNote is a Commentary on a Word or Sentence that appears as a Number at the top right of either a Word or the last Word of a Sentence. The Number refers to a Word, Sentence or Paragraph that appears at the PageBottom. It is defined as:

[2] The Athenian Alphabet is closer to the Latin Alphabet, but the Latin Alphabet itself stems from the Chalkedean Alphabet.

Name	Capital	TEX	Low	TEX
Alpha	A	A	α	\alpha
Beeta	B	B	β	\beta
Gamma	Γ	\Gamma	γ	\gamma
Delta	Δ	\Delta	δ	\delta
E-psilon	E	E	ϵ	\epsilon
Zeeta	Z	Z	ζ	\zeta
Eeta	H	H	η	\eta
Theeta	Θ	\Theta	θ	\theta
Iota	I	I	ι	\iota
Kappa	K	K	κ	\kappa
Lambda	Λ	\Lambda	λ	\lambda
Mue	M	M	μ	\mu
Nue	N	N	ν	\nu
Xi	X	X	ξ	\xi
O-micron	O	O	o	o
Pi	Π	\Pi	π	\pi
Rho	P	\Rho	ρ	\rho
Sigma	Σ	\Sigma	σ	\sigma
Tau	T	T	τ	\taus
Ue-psilon	Y	Y	υ	\upsilon
pFi	Φ	\Phi	ϕ	\phi
C-hi	X	X	χ	\chi
Psi	Ψ	\Psi	ψ	\psi
Oo-mega	Ω	\Omega	ω	\omega

Table 38.1: The Greek Characters and their Tex-Equivalents. Note that their Pronunciation is based on the ancient Greek Pronunciation which has perished.

Def. 38.5.0.1*:* **FootNote (Publishing):** is a named Reference on top right of a Word, that includes a Commentary local to the Page and placed at the Bottom of a Page.

A FootNote is added by using the "\footnote"-Command where inside the Braces you add your Text. Remember to attach the Footnote after the last Character of the Sentence. Typically after the "\footnote"-Command comes the "Period"-Character.

```
<Attachment of a FootNote>:=
   \footnote{<Text>}
```

E.g.

```
The General closed the Door\footnote{The
    General was responsible for the
    Soldiers.}.
```

which results:

The General closed the Door[3].

A FootNote can be attached in a SectionTitle inside the TitleText, but it requires the Package "footmisc" with the Option "stable".

E.g.

```
\usepackage[stable]{footmisc}
...
\chapter{The Car as Philosphy\footnote{
    Yes the Car has its own Philosophy
    !}}
```

38.6 Color

In this Section, when I speak of Color, I speak on the Emission of colored Light from a Source like a Lamp, not the Absorption of white Light from a painted Surface and its ColorPerception. There is a Correspondence of both ColorObservations (Emission and Absorption) that I will not go in Detail. While the Mixing of Colors with a Paintbrush gives a certain Hue that a Painter seeks, i.e. blue and yellow Paint will mix to give Green, this is not the Situation that occurs with the Mixing of Light, something that it will be shown later. Incidentally, the ColorPalette of a Painter consists of five Colors, these are Black, White, Red, Yellow and Blue, with all the other Colors be derived by the Mixing of these Colors.

Color is an optical Sensation that affects the biological Function called "Sight" which is the Responsibility of the Organs "Eyes". A normal Human sees about 25 Shades of Gray [4] and Millions of Colors

[3] The General was responsible for the Soldiers.

[4] The gray Color represents the Intensity of physical Light, and spans from white Color, that is full Illumination, to the black Color, which is full Darkness. Some People can see 30 Shades of Gray. I suspect that the MotionPicture 50 Shades of Gray deals with a Name called "Gray"; No, I don't watch such Movies since they are Poison to the HumanSoul: they are much more poisonous than Porn. I saw by the Way the Trailer.

that give to the LightIntensity a different Sensation (Red, Green and Blue are the primary ColorSensations of white Light giving Millions of different Permutations of Colors).

See Figures 38.1 for a gray Spectrum and the same Spectrum in 38.2 divided into 30 Shades of Gray. See also the RainbowSpectrum in Figure 38.3.



Figure 38.1: They Luminocity- AKA gray Spectrum.

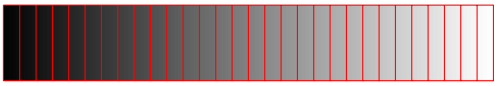


Figure 38.2: The gray Spectrum divided into 30 Strips. See which one you cannot discriminate.



Figure 38.3: The visible (to the HumanEyes) LightSpectrum. Note that this Spectrum was designed as symmetric, i.e. the Colors are described in Coordinates as equally distributed. In Reality the Spectrum, and in particular the SunSpectrum looks somewhat asymmetric, due to the GradationAlgorithm and its Correlation to the visual System of Humans.

The primary ColorSensations are collectively called “Channels” (in digital ImageProcessing), and in “latex”, they have usually decimal Point Values, starting from 0.0 and ending to 1.0. Once they will forwarded to an electromechanical Printer, the Colors will be processed and then mapped to the ColorPaints that the Printer holds, these ColorPaints are Black, Magenta, Cyan and Yellow. Note that typically the Printer does not have a White, since the Paper is mostly White. In addition, you will never find (not easy at least) ColorPigments for green Color due to the Problem of illegal Printing of Money, in particular Dollars.

Let three LightSources, a Red, a Blue and a Green. When these LightSources are placed as shown in Figure 38.4, their Colors are added and produce the four additive Colors, the Yellow, the Cyan, the Magenta and the White. Variations of the Colors is done by regulating the Intensity of the LightSource.

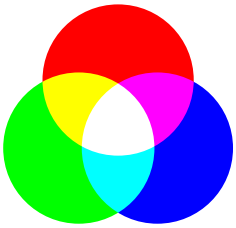


Figure 38.4: The three ColorChannels of Light and their Addition to produce other Colors.

Let three PaintSprays, a Magenta, a Cyan and a Yellow that act on a white Surface. Then when the Colors are added produce four additive Colors, the Red, the Green and the Blue. Variations of Colors is done by regulating the Amount of Pigments that each Color contain as well as adding black Color to darken the Pigments. This is shown in Figure 38.5.

When we are using “Latex”, we program the DocumentParts in Color based on “Light”-Parameters. When we send to actually print on Paper the DocumentPart, then the “Latex”-System together with the PrinterSettings will print a Document that follows very closely our coloring Requirements, but the Colors will be Pigments on Paper.



Figure 38.5: The three ColorPigments and their Addition to produce other Colors.

38.6.1 The "Color"-Package

The "color"-Package is used for the Coloring of various Elements in a Document. The Package defines the following Colors:

white, lightgray, gray, darkgray, black, violet, blue, cyan, teal, olive, green, lime, yellow, orange, brown, magenta, pink, purple, olive, pink.

Correct ColorAssociation with the Text can lead to better Readability and aesthetic Perception of the "End"-Document. However for sensitive Documents, the Colors should focus only on the critical Aspects of ReaderContent in order to call the Attention of the Reader. For the Issue of Color see [White] [5] .

38.6.2 Color of PageBackground

You can color the DocumentBackground of the DocumentPage by using the Command:

```
\pagecolor{<ColorName>}
```

Here an Explanation is required. Coloring a DocumentBackground is necessary in the electronic Format of the Document or in electronic TradingCatalogues. For PaperDocuments with colored Backgrounds on complete Pages (i.e. two sided Page), typically the Publisher will use his own colored Paper and the Printing will be ignoring the ColorBackground of the "Tex"-Document (unless if something Different is specified). However with current Technologies, the Cost diminishes and is not so much an Issue.

Now on the Meaning of the "\pagecolor"-Command: this Command will color the subsequent Pages, therefore is better to enclose it in an anonymous Environment. However the "Measures" are not over! You should also take care so that any other Paragraph that follows, is on a next Page.

38.6.2.1 Color of PageBackground and The Cold War

And now a short Story from Cold War: In the Past, some secured Documents were made by printing them in dark gray Background with black Characters, so that the DocumentScanning with xerographic Machine (i.e. Photocopier) would be difficult or impossible. Today, with high quality Cameras, this Sort of technology is redundant, and replaced with electronically encrypted Text on e-Paper. **Lesson of the story: You should not use a new Technology to reproduce old Technology unless the Benefits outperform the Hazards of old Technology.**

38.6.3 TextColor

You can colorize your Text, collectively or specifically. To collectively color the Text in your Document, you need to add the following Code:

```
<Define the TextColor>:=
   \textcolor{<ColorName>}{<ReaderText>}
```

E.g.

```
\textcolor{violet}{This is it.}
```

which gives:

This is it.

To color the Headings of the Document add the Package **"sectsty"** and then use FontStatements for the DocumentParts. In this Document I have used the following Colors (some defined myself actually) which are before the "font"-Commands for

[5] What a White to speak you about Color? Yes! See: White, Jan V. Color for Impact. Strathmoor Press, USA, 1996.

Sections (this Subject I don't cover it here but be fair I mentioned it). For these I have used the "\color"-Command.

```
\chapterfont{\color{blue}}
\sectionfont{\color{cyan}}
\subsectionfont{\color{coquelicot}}
\subsubsectionfont{\color{cadmiumgreen}}
\paragraphfont{\color{byzantine}}
```

E.g. If I apply the "SectionFont"-Commands I will get for this Script:

```
\begin{itemize}
   \item \textcolor{blue}{Chapter}
   \item \textcolor{cyan}{Section}
   \item \textcolor{coquelicot}{
        Subsection}
   \item \textcolor{cadmiumgreen}{
        Subsubsection}
   \item \textcolor{byzantine}{Paragraph}
   \item \textcolor{swisspink}{Questions
        and Exercises}
\end{itemize}
```

which gives:

- Chapter
- Section
- Subsection
- Subsubsection
- Paragraph
- Questions and Exercises

38.6.4 Defining color

In order to define Colors that are not Part of a Palette, you can use the "\definecolor"-Command and then the red, green, blue decimal Point Numbers to create the necessary Intensity of each ColorChannel.

The "definecolor"-Command has the Form:

```
\usepackage{color}
...
<ColorDefinition>:=
   \definecolor{<ColorName>}{rgb}{<DV>,<
        DV>,<DV>}

where

<DV> := DecimalValue:=0.0 to 1.0
```

In this Document I defined the among others the following Colors:

```
\usepackage{color}
\definecolor{emerald}{rgb}{0.31, 0.78, 0.47}
\definecolor{purple(munsell)}{rgb}{0.62, 0.0, 0.77}
\definecolor{cinnabar}{rgb}{0.89, 0.26, 0.2}
\definecolor{cadmiumgreen}{rgb}{0.0, 0.42, 0.24}
\definecolor{coquelicot}{rgb}{1.0, 0.22, 0.0}
\definecolor{byzantine}{rgb}{0.74, 0.2, 0.64}
```

where {rgb} refers to the Red-, Green-, BlueSet and the Numbers to the Light-Intensity of each Color Channel (0.0 until 1.0). Note that if you have a ChannelColor accepting Values from 0 to 255 (i.e. 8-Bit Values, where the Range is $[0, (2^8) - 1] = [0, 255]$ you can divide this number with 255 in order to get the decimal Value of the Channel. E.g. the Value 133 becomes $133/255 = 0.5216$

38.6.5 ColorBox

A ColorBox is just a Box with Color. So nothing really special unless it holds something special in a TextLine. There are two Options here, the first concerns coloring of the Background, the second concerns coloring of Background and the BoxEdges.

You can color a Box for making the Text vibrant, using the Statement:

```
<Create a ColorBox withe colored
   Edges and Background>:=
\fcolorbox{<PlacementColor>}...
   {<BackgroundColor>}
```

E.g. The following Code

```
\fcolorbox{blue}{gray}
{{\textcolor{orange}{\Large This is it}}}
```

gives:

This is it

Chapter 39

Listings and Figures

39.1 CodeListings

A CodeListing is an Area within the ReaderContent where ProgrammingCode is listed. By Definition:

Def. 39.1.0.1*:* **CodeListing:** is a Text that lists the "ComputerLanguage"-Program and is intended to be read by a HumanReader.

There are two Ways to add CodeListing, either with the "verbatim"-Environment or the "lstlisting"-Environment.

To understand "verbatim" you must understand the Term "verbal":

Def. 39.1.0.2*:* **Verbal (Art of Speech) (Adjective):** means "spoken" as opposed to "written".

E.g. The Lawyer made the verbal Statement that he agrees with the Witnesses.

The Term "verbatim" derives from the Term "verbal" in a Sense that describes something as was precisely said or found written.

Def. 39.1.0.3*:* **Verbatim (Publishing) (Adverb):** means precisely as was said or found written.

E.g. The Lawyer provided the Statement of his foreign Client verbatim: "I am agreeing to the Judgment."

39.1.1 Verbatim

The "verbatim"-Environment is a Environment for Paragraphs and displays the Paragraphs as were entered, together with additional Spaces if any. E.g.

```
\begin{verbatim}
   She walk oN the   door and open it.
\end{verbatim}
```

which provides:

```
She walk oN the   door and open it.
```

An interesting Use of "verbatim" is to make CodeListings. These are simple in Form but sufficient for simple Coding.

E.g. a VHDL-Example with "verbatim":

```
\begin{verbatim}
Entity Encoder is
Port( X: in std_logic_vector(1 downto 0);
      S: in std_logic;
      Y: out std_logic);
end Encoder;
\end{verbatim}
```

which gives:

```
Entity Encoder is
   Port( X: in std_logic_vector(1 downto 0);
   S: in std_logic;
   Y: out std_logic);
end Encoder;
```

While "verbatim" is nice for small Code, when we are placing "Latex"-Code, it might get problematic, in particular for the Sequence "\end {verbatim}". However it is nice for BNF-Code, though it does not provide Coloring as other "CodeListing"-Packages:

```
\begin{verbatim}
<EntityDeclaration>::=
   {<Declarative Items>)
\end{verbatim}
```

which displays:

```
<EntityDeclaration>::=
   {<Declarative Items>)
```

Sometimes the "\verb||"-Command is used for inlined Code.

```
The Person noted that the Command
\verb|\TeX| was written with
Capital ``X''.
```

Which displays:

The Person noted that the Command `\TeX` was written with Capital "X".

Note that the Verbatim for only the vertical Bar is given as "\verb£|£"-Command. E.g. `|` .

39.1.2 Listings

Another Way to add a CodeListing is to use the **"listings"-Package**. You include the Code to the following "lstlisting"-Environment and in addition, Tab, Space, are freely allowed. The CodeListing has the Form:

```
\begin{lstlisting}
   <Code to be added>
\end{lstlisting}
```

as well as a Preamble that can enclose the whole Set of Documents or single Document or an anonymous Environment. The Preamble is the "lstset" which can arrange the Styles of the CodeListing.

E.g. A Style for C++, its Variant "ISO" with various Settings is shown here:

```
\lstset{
   language={[ISO]C++},
   rulecolor=\color{gray!30!white},
   breaklines=true,
   basicstyle=\tt\scriptsize,
   keywordstyle=\color{blue},
   identifierstyle=\color{cadmiumgreen},
   stringstyle=\color{purple(munsell)},
   tabsize=3}
```

E.g. Display "C Plus Plus"- Code using the "lstset" and the "lstlisting"-Environment:

```
{\lstset{
      language={[ISO]C++},
      rulecolor=\color{gray!30!white},
      breaklines=true,
      basicstyle=\tt\scriptsize,
      keywordstyle=\color{blue},
      identifierstyle=\color{cadmiumgreen},
      stringstyle=\color{purple(munsell)},
      tabsize=3}
\begin{lstlisting}
public static void main(String[ ] args)
{
   prt("BlaBla");
}
\end{lstlisting}
}
```

will display:

```
public static void main(String[ ] args)
{
   prt("BlaBla");
}
```

In the Case that you have a CodeFile to display, then you can use a Form that allows to embed the File. In this situation you don't have to copy the File to the "Latex"-Software, but you just refer to the File:

```
\begin{lstlisting}
   \lstinputlisting{
      <DirectoryName>/<"SourceFile"-Name>}
\end{lstlisting}
```

E.g.

```
\lstinputlisting[basicstyle=\tiny]
   {Part_CPP/FunCall.cpp}
```

will list the File:

```
//Example 5: Functions and function calls
#include <iostream>
using namespace std;
void FunctionOne();
void FunctionTwo();
void FunctionThree();

int main()
{
   cout<<"main\n";
   FunctionOne();
   FunctionTwo();
   cout<<"main\n";
   return 0;
}

void FunctionOne()
{
   cout<<"Function One\n";
   return;
}

void FunctionTwo()
{
   cout<<"Function Two\n";
   FunctionThree();
   return;
}

void FunctionThree()
{
   cout<<"Function Three\n";
   return;
}
```

You can also highlight the particular Language accordingly. You put the Options as such:

```
\begin{lstlisting}
   \lstinputlisting[
      language={[ISO]C++},
      rulecolor=\color{gray!30!white},
      breaklines=true,
      basicstyle=\tt\scriptsize,
      keywordstyle=\color{blue},
      identifierstyle=\color{cadmiumgreen},
      stringstyle=\color{purple(munsell)},
      tabsize=3]
      {<Directory-Name>/<Source-File-Name>}
\end{lstlisting}
```

This will display:

```
//Example 5: Functions and function calls
#include <iostream>
using namespace std;
void FunctionOne();
void FunctionTwo();
void FunctionThree();

int main()
{
   cout<<"main\n";
   FunctionOne();
   FunctionTwo();
   cout<<"main\n";
   return 0;
}

void FunctionOne()
{
   cout<<"Function One\n";
   return;
}

void FunctionTwo()
{
   cout<<"Function Two\n";
   FunctionThree();
   return;
}

void FunctionThree()
{
   cout<<"Function Three\n";
   return;
}
```

The Settings for CodeListings can include many Options such as TabulatorSize, Colors of Keywords, BackgroundColors etc.

To include a Listing within the Paragraph use the “lstinline”-Command and enclose in the Braces the Content.
E.g.

```
{\lstinline[<Options>]{<Code to be listed>}}
```

E.g. This is the Code:

```
{\lstinline[language={[ISO]C++},
   rulecolor=\color{gray!30!white},
   breaklines=true,
   basicstyle=\tt\scriptsize,
   keywordstyle=\color{blue},
   identifierstyle=\color{cadmiumgreen},
   stringstyle=\color{purple(munsell)},
   tabsize=3]
   {cout<<"Please enter DiskName: ";}}
```

which displays:

```
cout<<"Please enter DiskName: ";
```

Obviously for demonstration of Coding, the Settings for CodeDisplay will be isolated from the Command and included somewhere. In this Example, I had to demonstrate the whole Idea.

39.2 Figures

To add Figures in your Text you can use the “figure”-Environment described next:

```
\begin{figure}[<PlacementOptions>]
   <FigureJustification>
   <Inclusion of Graphics>
   <Caption>
   <Label>
\end{figure}
```

The Reference to the Figure is made within the Text with the “\ref”-Command:

```
\ref{fig:<ReferenceLabel>}
```

While the Reference that the Figure contains is made within the “figure”-Environment with the “\labal”-Command:

```
\label{fig:<ReferenceLabel>}
```

The Caption of the Figure is made with the “\caption”-Command within:

```
\caption{<Commentary to the Figure>}
```

The Figure has actually two Variations, one of which is the AsteriskForm, i.e. `\begin{figure*}...\end{figure*}`.
The AsteriskForm is for the “two Column”-Format and as such has its own Specifications. E.g. the Figure is placed between the Columns.

In a “figure”-Environment you can use the “centering”-Command to justify the Figure within the Page.

39.2.1 The "includegraphics"-Command

The Command "includegraphics" is Part of the Package "graphics" and as Command is used to embed ImageFiles. It has the Form:

```
<Inclusion of Graphics>:=
   \includegraphics[<GraphicsOptions>]
      {Directory/<File-Name>.<File-
          Extension>}
```

The "DirectoryReference"-Rules are as usual.

E.g. to include the ImageFile "ControlSys.pdf" you use:

```
\includegraphics{Latex/ControlSys.pdf}
```

You can include more than one Figures in the "figure"-Statement. For that, you can put one "includegraphics"-Statement after the other.

39.2.1.1 GraphicsOptions

The "figure"-Environment includes a "GraphicsOptions"-Section which might contain the Following among others:

1. **scale**: This is the ScalingAmount a Figure can occupy as a "decimal Point"-Value.
2. **height/width**: This is how much Height/Width we allow the Figure to extend. Both Values are "chained" and only explicit Reference to both, can make the Image to extend accordingly
3. **angle**: This specifies an RotationAngle in Degrees as positive or negative "decimal Point"-Values. Negative Angles rotate the Figure clockwise, similarly to the Feeling you got when in your Loneliness you enter the very large WashingMachine. Adié miserable World!
4. **bb**: This is the "Bounding-Box"-Parameter that allows a Box to enclose the Illustration, i.e. it frames the Image.

E.g. A scaled by a Factor of 1.2, framed Image, rotated clockwise by 30 Degrees:

```
\includegraphics[scale=1.2, angle=-30, bb
    ]
```

will display the Image as following in 39.1:

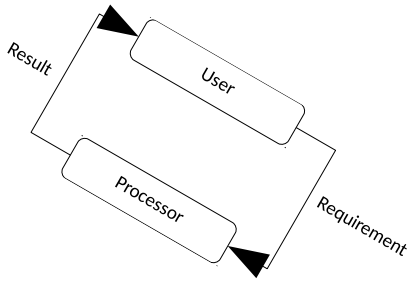


Figure 39.1: This is a scaled and rotated framed Image

On the Subject of Scale, complicated Illustrations need extensive Space to display their Details, simple Illustrations need small Space concerning their Details. Consequently the ImageScale should have an appropriate Value.

39.2.2 FigurePlacement

A Figure has some Controls that are easy to use and somewhat disturbing to deploy. As always the self respected "Latex"-Editor will initially learn the Basics and eventually will try his Luck to more detailed Settings until the Game of Russian Roulette is the only Option left☠. **This is the Way™**.

Directly after the "figure"-Environment are placed Options inside a BracketsPair. These Settings correspond to the Placement of the Figure and are called "LocationSpecifiers". LocationSpecifiers and are:

- **h**: this indicates that the Figure will appear directly when is declared,

where “h” stands for “here”. Consequently, the Figure follows the ReaderText.

- **t**: this indicates that the Figure is *requested* to be at the Top. If this is not possible, well the Russian Roulette becomes a viable Option: the Figure will be located in the Top of the next Page.

- **b**: this indicates that the Figure is *requested* to be at the Bottom. If this is not possible, then it will located at the Bottom of the next Page. Silver Hair might appear, welcome to the Club.

- **p**: this indicates that the Figure will be located in a special Page.

E.g. This Figure, 39.2, follows the Text:

```
\begin{figure}[h]
   \centering
   \includegraphics[scale=1.0]
      {Part_Latex/DocumentStructure/ControlSys.pdf}
   \caption{This is a ControlSystem}
   \label{fig:ControlSys}
\end{figure}
```

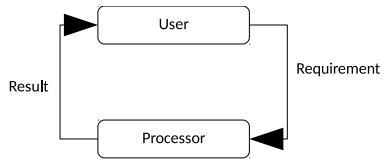


Figure 39.2: This is a ControlSystem

Sometimes the Character “!” appears after the FigureSettings. This Character is the “float”-LocationSpecifier and has the Purpose to relieve the Figure from some Restrictions concerning its current Placement.

39.2.3 Lists of Figures

A FigureList can be created by using the Command “\listoffigures”. The List that is produced, has as Reference the FigureCaption which is demanded to be filled.

39.2.4 The PictureEnvironment

The “picture”-Environment is used when a “Latex”-Editor wants to create a Picture from the most based Artifacts, such as Lines, Boxes etc. It is phased out in normal EditingMode in Favor of other Packages such as Tikz, Metapost, PGF etc.

The following Example of “picture”-Environment, 39.3 is provided from “Latex2e”-Organization and is DocumentationPart of “TeXstudio” Version 4.8.4. The Example is provided for Demonstration, not for Learning. Image is scaled to 0.5cm, instead of 1cm

```
\begin{figure}[h]
   \centering
   \setlength{\unitlength}{0.5cm}
   \begin{picture}(6,6)
      \put(0,0){\vector(2,1){4}}
      \put(2,1){\makebox(0,0)[l]{\ first
          leg}}
      \put(4,2){\vector(1,2){2}}
      \put(5,4){\makebox(0,0)[l]{\ second
           leg}}
      \put(0,0){\vector(1,1){6}}
      \put(3,3){\makebox(0,0)[r]{sum\ }}
   \end{picture}
   \caption{Example of ‘‘picture’’-
       Environment}
   \label{fig:PictureEnvironment}
\end{figure}
```

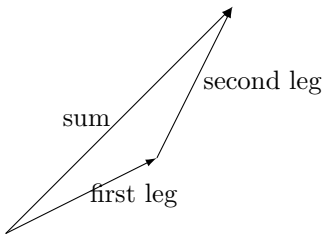


Figure 39.3: Example of “picture”-Environment

Chapter 40

TableElements

40.1 Table of Data

A **Table of Data** AKA **Table** is an graphical DataPlacement within Areas designated by horizontal Lines (AKA "Rows") and vertical Lines (AKA "Columns"). Typically the Table will contain the Description of Data in additional Rows and Columns embedded to leading, or perceived as leading, Positions. E.g. See the Table 40.1

Index	Name	Job
1	Chris	Engineer
2	Danielle	Geologist

Table 40.1: A simple Table

Having a rough Description of a Table, it is Time to give a proper Definition.

Def. 40.1.0.1*:* **Table of Data AKA DataTable:** is a rectangular Arrangement of Data placed in a grid of horizontal and vertical Lines where each Datum resides in an empty Space called "Cell".

A important Note on Latex Tables: The Tables have so many Settings, that I will need Chapters to cover them. I provide here only a very small View about the Abilities and Capabilities of Tables. If you require more then you should consult a more advanced Text as well as the "Latex"-Documentation [1] .

[1] Perhaps a Doctor if Symptoms of your Illusions persist.

40.2 Creation and location of Table

There are two ways to create a Table. The first is to have the Table ready from a Spreadsheet and to add the Spreadsheet as a Picture. This is as easy it gets, just have it in an appropriate Format. The second, is to start typing the "Latex"-Commands so that the "Latex"-Software can create a Table. Note that there are supporting Programs for creating a "Latex"-Table from the Data described in the Spreadsheet and this should be the appropriate Way to create simple Tables, or at least Use for an intended TableStructure to build from [2] .

A "Latex"-Table can be placed immediately after the Text or can be placed in an optimal Position as a floating Object. The immediate Placement is the default Behavior, while the floating Placement needs some Tinkering.

40.3 Text- and mathematical Tables

There are two Types of Tables according to **TextMode** or **mathematical Mode** corresponding to the Environments **"tabular"** and **"array"** respectively. However the ConstructionParameters are the same

[2] The Software "TeXstudio" has a "Wizard"-Process for creating a Table.

for both Types. Consequently, to declare Tables use the Form:

```
<TableDeclaration>:=
   \begin{tabular}[<TableParameters>]
      <Labels><Data>
   \end{tabular}
```

Typically the “tabular”-Environment is placed inside a “figure”-Environment or “table”-Environment, which obviously the “table”-Environment is more appropriate.

40.4 CellParameters of the Tables

A Table contains Enclosures called “Cells” where each Cell contains either a Datum or a Label. To delimit each Datum or Label on its Column, use the Ampersand, &, and to delimit each Row use two Backslashes, \\.

E.g. Place Data to Three Columns and two Rows:

```
Tom & Mark & Sammy\\ %First row, three columns
Joanna & Linda & Mary\\ %Second row, three columns
```

will give the Table 40.1:

Tom	Mark	Sammy
Joanna	Linda	Mary

Figure 40.1: The implemented Table as Separation of & and \\.

Note: there are more to this Code, that is not shown! This is done due to the Complexity of Tables. Keep reading!

A Table can have, indeed this is the typical ConstructionMethod, **horizontal** and **vertical Lines** for separating each Cell. The horizontal Lines are given after a RowDeclaration with the Command “hline” (horizontal Line). Before the first Row, an “hline” can also be declared. Here I don’t show the Mechanism or Result of vertical Lines.

E.g. Three horizontal Lines in a Table.

```
\hline %This horizontal Line bounds the Cells above them
Tom & Mark & Sammy\\
\hline %This horizontal Line bounds the Cells below them
Joanna & Linda & Mary\\
\hline %This horizontal Line bounds the Cells below them
```

Will give 40.2:

Tom	Mark	Sammy
Joanna	Linda	Mary

Table 40.2: The implemented Table as Separation of Lines between the Cells.

The “tabular”-Environment has some Parameters that are Part of its Construction.

```
<TableParameters>:=
   "["<Position>"]""{"<ColumnFormat>"}"

where:

<Position>::=<No argument>|<b>|<t>
<b>::=Position regarding PageBottom
<t>::=Position regarding PageTop
<No argument>::=Position regarding PageMiddle

and

<ColumnFormat>::=
   <Graphical and textual Format of Columns>
```

The Options in ColumnFormat are many. These Options are enclosed in Braces as a CharacterString in one Group. This is the Part that gives Headache to the Novice but Satisfaction to the Professional [3] together of Course with some severe Headache. Anyway, the most common Options are:

- **Justification of Text**: here the Codes are **“l”, “r”, “c”** standing for left, right and centered.
- **Vertical Line Delimiters for enclosing a Cell**: “|” and “||” are single and double straight Lines.
- **Paragraph insertion in a Cell**: Sometimes a Cell can contain a Sentence or even a Paragraph. The Command **p{\dot{T}extWidth}^*** creates an ParagraphBox of specific Width of included CellText.

E.g. Please study the Example and understand its Coding.

```
\begin{tabular}{| c || r || l|}
   \hline
   Tom & Mark & Sammy\\
   \hline
   \hline
   Joanna & Linda & Mary\\
   \hline
\end{tabular}
```

[3] Similar to his Gender reassignment. Ouch! Where’s my Penis?

will give 40.3:

Tom	Mark	Sammy
Joanna	Linda	Mary

Table 40.3: The full Table.

40.5 External Parameters to "tabular"-Environment

The "tabular"-Environment can be influenced by external Parameters to accommodate itself to some Settings by the "Latex"-Editor. Three important Parameters are:

- The TablePlacement within the Page as floating Object
- The TableJustification regarding the surrounding Paragraphs
- The CellHeight in a Table.

To create a **floating Table** enclose the "tabular"-Environment to a "Table"-Environment.

```
\begin{table}[<Position>]
   <Actual Table with ``tabular''-
       Environment>
\end{table}
```

where

```
<Position>::=
   <No argument>|<b>|<t>|<h>|<b>!|<t>!|<h
       >!
Where
<b>::=Position regarding PageBottom
<t>::=Position regarding PageTop
<h>::=Position regarding by relative
   Approximation here
<Character>"!"::= Position by
   overriding the Parameters for
   an intended Optimum
<No argument>::= Floating Position
   according to the default Optimum.
```

To justify the Table regarding the surrounding Paragraphs use the equivalent Environments, "flushright", "center" and "flushleft" before the "tabular"-Environment.

```
\begin{<JustificationCommands>}
   <Actual Table with
   ``tabular''-Environment>
\end{<JustificationCommands>}
```

E.g. PageCentering of Table:

```
\begin{center}
   \begin{tabular}
      <Table>
   \end{tabular}
\end{center}.
```

For isolating the **JustificationScope** in a float Object, it is recommended first to make the Object "Float" and then to justify the Object (Examples follow).

To increase the Distance between the Rows use the "\arraystretch"-Command to redefine the Parameter. A suggested Factor is above 1.3. The "\arraystretch"-Command is declared before "tabular"-Environment as:

```
\renewcommand{\arraystretch}{<Factor>}
\begin{tabular}
   <Table>
\end{tabular}
```

40.5.1 Caption and reference in tables

Captions and References (Labels) are placed either before or after a "tabular"-Environment where this Environment is enclosed to a "table"-Environment.

E.g.

```
\begin{table}
   \begin{tabular}
      <Table>
   \end{tabular}
   \caption{<Text>}
   \label{<Reference>}
\end{table}

where

<Reference>:=tab":"<ShortName>
```

40.5.2 TextSize of a Table

To have the Table in a particular Size, use the Declaration or the Environment of the TextSize before the "tabular"-Environment.

E.g. The following Table has "tiny"-FontSize.

```
{\tiny
   \begin{tabular}{r r r}
      Tom & Mark & Sammy\\ %First row, three columns
      Joanna & Linda & Mary\\ %Second row, three columns
\end{tabular}}
```

This is shown in 40.4:

Tom	Mark	Sammy
Joanna	Linda	Mary

Table 40.4: The Table with "tiny"-FontSize.

40.5.3 FontMarkings in tables

The Fonts can be changed inside a Table on DatumBasis. Consequently, bold Fonts, international Fonts etc. can all changed as usual.

40.5.4 Common TableForm

The following TableForm is the most common:

```
\begin{table}[<TablePlacement>]
   \begin{<TableJustification>}
      <TextSize of Table>
      <CellHeight>
      \begin{tabular}[<Position>]
         {<ColumnFormat>}
         \hline
         Name & Name & ... \\
         Value & Value & ... \\
         .
         .
         .
         Value & Value & ... \\
      \end{tabular}
   \caption{<Text>}
   \label{tab:<TableName>}
   \end{<TableJustification>}
\end{table}
```

40.5.5 Examples of Tables

In this Example a Table is created for three Columns and three Rows, left justified each Datum in its Set, separated by four horizontal Lines and four vertical Lines.

```
\begin{table}[h!]
\begin{center}
   \renewcommand{\arraystretch}{1.5}
   \begin{tabular}{|l|l|l|}
      \hline
      1 & 2 & 3 \\
      \hline
      4 & 5 & 6 \\
      \hline
      7 & 8 & 9 \\
      \hline
   \end{tabular}
   \caption{This is a Table of Numbers}
   \label{tab:Table_1}
\end{center}
\end{table}
```

Will give 40.5:

1	2	3
4	5	6
7	8	9

Table 40.5: This is a Table of Numbers

In the following Example there is a Table with three Columns, three Rows, in which the first Row and the first Column describe the Data in the Table. The last Column allows Space for a large Number that is a *Blasphemy* to numerate[4]. Additional "double Precision"-Lines have been added to visually separate the Data from their Labels and thus making your Life a little bit less miserable than currently is.

```
\begin{table}[h!]
   \begin{center}
      {\renewcommand{\arraystretch}{1.5}
         \begin{tabular}{|l||l|l|p{2cm}|}
            \hline
            & \textbf{Property A} &
               \textbf{Property B}\\
            \hline\hline
            \textbf{Set A} & 5 &  \seqsplit
                  {27398407523054823750234 7
               52734582390572390572349
               85273045938572839407592340}\\
            \hline
            \textbf{Set B} & 8 & 9 \\
            \hline
         \end{tabular}
      }
      \caption{This is a somewhat advanced Table}
      \label{tab:Table_2}
   \end{center}
\end{table}
```

Note that the **"tabularx"-Package** is usually used for some more difficult Cases, such as displaying Greek Characters inside a Table.

[4] For this the "seqsplit"-Package is listed under the same name in Packages and has the "seqsplit"-Command which breaks the Number. "seqsplit" Means "SequenceSplit", if you are too slow to comprehend, no Offense here, we respect your Disability.

	Property A	Property B
Set A	5	27398407523 05482375023 47527345823 90572390572 34985273045 93857283940 7592340
Set B	8	9

Table 40.6: This is a somewhat advanced Table

40.5.6 Special Tables

A special Table can have Aspects that go beyond the usual Construction such as:

1. Additional CellDivisions
2. Groupings of Cells
3. Graphics on Cells
4. Nesting of Tables

These are very special Aspects of TableDesign and will not covered here. Consult other Texts, or use a **"TableDesign"-Tool**. Sometimes, taking a Snapshot of a well arranged Spreadsheet from a WordProcessor is quicker than creating the Table: **Don't fuck it up however.**

40.5.7 Lists of Tables

A TableList can be created by using the Command "\listoftables". The List that is produced, has as Reference the Table-Caption which is demanded to be filled.

Chapter 41

References and CommandConstructions

41.1 References

A scientific Text contains **References** to other Texts, for its Support. A Reference requires two Parts, a **Label** to the referenced Area and a **Reference** to the Label; it is the latter Reference that is used to point to the Area of cross-checking.

You can declare a Label by using the Statement **\label{Option: Name}**, where "Name" refers to the Name we have given to the Reference inside the "Latex"-Typesetting. This Label will be next to the Area of Interest. Note that you need also a Name for the Label. The Options available are:

- ch: chapter
- sec: section
- subsec: subsection
- itm: enumerated list item
- lst: code listing
- fig: figure
- tab: table
- eq: equation
- alg: algorithm
- app: appendix subsection

Once you are done with the Label, you can use make a Reference using the Command **\ref{Option: Name}**. Again, the Option-Section is the same as in the "label"-Command.

41.2 New Commands [1]

There are two Methods of writing "Latex"-Commands, one by using the most basic Form of "Tex", called "plain Tex" and the other by using a "Latex"-Commands together with some special Programming.

The Creation of a new Command based on "Latex" is the Object of this Section. A new Command typically (but not necessary) acts as an Alias for a long Set of Commands and as such reduce the Writing of the "Latex"-Editor. In Essence, an Alias acts as a Grouping which encloses the DesignAspects by removing the Details from the "Latex"-Editor.

The Command "\newcommand" is used for creating such an Alias. It has the Form:

```
<New Command>::=
    \newcommand{<"\"NewcommandName>}
        [<ParameterNumber>]
        {<Commands and Parameters>}
```

[1] The Commands provided here touch the Subject of mathematical Editing. This shouldn't any Problem here, since the Material should be just covered and when mathematical Editing is learned in the next Chapter, the Reader can come back to resolve any Misunderstandings.

Once that the Form is completed, then the new Command can be called either with an Argument or not.

```
<"New Command"-Instance>:=
   "\"<CommandName>[<Parameters>|<
        Arguments>]
```

The "\new"-Command works for "Latex" or "math"-Environment as follows:

1. A new Name for a Command is declared.
2. Optionally a Number between 1 to 9 is added to declare the ParameterNumber that the Command accepts.
3. One Command is entered in the desired Form
4. If the Command has one or more Parameters, then each desired Parameter is a Number preceded by the Hash (AKA Pound AKA Number sign #). The Number can be in an Order of Appearance inside the new Instruction and as much many Times as required.
5. A Declaration of the new Command can be done before its Use; However and for keeping your Sanity, typically the Declaration takes place on the Preamble of the "Latex"-DocumentSet.
6. The Use of the new Command takes none, one or more Arguments within Braces, where each Argument corresponds to one Parameter [2] .

Remark 41.2.0.1. There are some Recommendations on new Commands:

- Check before you implement the Command if the CommandName is reserved [3] .
- I suggest that each new Command that you create has your Acronyms at the Start of the Command, E.g. "CNpvr" [4] .

Having said enough about Commands is Time to see Examples.

41.2.1 CommandReplication

E.g. Replicating a Command: the following new Command is called "CNemphasis" and corresponds the EmphasisCommand by Replication.

```
{
   %This typically in Preamble
   \newcommand{\CNemphasis}{\emph}
   %This in ReaderContent
   \CNemphasis{Hi} Thomas
}
```

It has the outcome: *Hi* Thomas

The name "Thomas" was added for demonstrating that the scope of the new Command is limited within its Domain, given by the Braces. I could have place the Braces outside the Command as a Scope:

```
{
   \newcommand{\CNemphasis}{\emph}
   ...
   {\CNemphasis Hi} Thomas
}
```

This will give:

*H*i Thomas

However if the Command was not constraint then it will affect all the Text after.

41.2.2 Command with two Arguments

The following new Command has two Arguments, one appearing after the other by a different Order of Appearance as entered. Both Arguments have the NumberSign, #, before them, while calling the Command with Arguments, requires Braces for each Argument.

[2] Surely someone has found more Ways to abuse this Function and I will not invite him to my BirthdayParty.

[3] You won't loose more Hair and your Libido will remain to the usual Level you deserve: **low**.

[4] In this Way you are sure that if you mess up is your Fault. It was always your Fault! Do you hear me Jim? It was always your Fault! She never loved you!

```
{
%This typically in Preamble
\newcommand{\Add}[2]{#2+#1}
...
%This in ReaderContent
\Add{5}{7}
}
```

The use of new instruction will lead to:
$7 + 5$

We can even place a two complicated Expressions into such a Command, but remember that you might need some Changes concerning the Parameters, i.e. enclosing a Parameter in Braces.

E.g.

```
\Add{x^{\sin{y}}}{7}
```

Leads to:
$7 + x^{\sin y}$

Similarly by isolating the Parameters we shield them from Errors:

```
{
%This typically in Preamble
\newcommand{\Add}[2]{{#2}+{#1}}
%This in ReaderContent
$\Add{x^{\sin{y}}}{7}$
}
```

Leads to:
$7 + x^{\sin y}$

41.2.3 Command with four Arguments

The following instruction contains four Arguments that can help a more complicated Command to be quickly defined.

```
{
\newcommand{\cnint}[4]
   {\int_{#1}^{#2} {#3}\,d{#4}}
...
$\cnint{0}{\pi}{x}{x}$

$\cnint{0}{cos(x)}{x^{\sin{x}}}{x}$
}
```

This will result to the following:
$\int_0^{\pi} x\,dx$
$\int_0^{cos(x)} x^{\sin x}\,dx$

41.2.4 Ensure Math

In the Commands for mathematical Contents, the Environments for “inline Formulas ”or “display math” are not explicitly cited. A Solution to this is to add a proper Command to assume that the Code written is actually mathematical. This proper Command is “\ensuremath”.

E.g. Previously the new Command

```
\newcommand{\cnint}[4]{\int_{#1}^{#2}
    {#3}\,d{#4}}
```

will be resolved as:

```
$\cnint{0}{cos(x)}{x^{\sin{x}}}{x}$
```

The Alternative is to use in the Definition the proper Command “\ensuremath”:

```
\newcommand{\cnint}[4]
   {\ensuremath{\int_{#1}^{#2} {#3}\,d
       {#4}}}
```

With this in Mind, we can write:

```
\cnint{0}{cos(x)}{x^{\sin{x}}}{x}
```

Which will give:
$\int_0^{cos(x)} x^{\sin x}\,dx$

Chapter 42

Mathematical Elements

42.1 Narrative

The Inception of "Tex" and subsequent "Latex" was the Ability to embed scientific Objects in a Text prepared by use of digital Technology. This was due to the inefficiency of Automation of manual Printing, an Issue that was overcomed by digital Technology. The following Content applies *inside mathematical Artifacts*. Note that I use **Metalanguage** to denote any Objects inside a Command; e.g. the word "Human" (any Person) inside a Command will be denoted as <Human>, while the Object "Joe" (a real Human), will replace the word "Human" in the Command as is.

My Purpose remains to provide a "Top to Buttom"-Approach of Learning. You should learn the Commands shown, as as they are shown, only when you encounter the next Sections, you should get to know the smaller Commands for Functions, Matrices etc. Just jumping in hot Water, does not make you Hero; Idiot however, for sure!

The American Mathematical Society, AMS, which is one of the greatest Organizations of mathematical Researchers, has its own "Latex"-Packages for mathematical Editing. These Packages are described here only on the Basis of the Commands that I refer, consequently I only touch their Names and two or three Commands. Since Academia depends on the ResearchEfforts of AMS, you might be compelled for your Research to use the corresponding Packages.

42.2 Inclusion of Expression

A particular Aspect that must be noticed is the Use of the Underscore _ followed by Braces { } as an InclusionArea for the Expressions.

E.g. `x_{1_{2_{3}}}`, which will give $x_{1_{2_3}}$.

This Method for including mathematical Expressions pervades most of the Symbols used for mathematical Expressions.

42.3 Mathematical artifacts

The driving Requirement behind Tex was the Documentation of scientific Artifacts that cannot be simple displayed in a textual Document, such as mathematical Formulas. A **mathematical Artifact** is a written Expression of mathematical Content. There are mainly two types of mathematical Artifacts in "Latex":

1. Inline Formulas
2. Displayed Formulas

Both these mathematical Artifacts are based on the Modes of Operation discussed previously. An Explanation of them is now due.

42.3.1 Inline Formulas

An **inline Formula** is a mathematical Artifact that is used inside the Text, in a Sentence or a Paragraph. For example $\int_0^\pi f(x)\,dx$ is an inline Formula.

To declare an inline Formula, use `\(<Formula>\)`. However, the DeclarationForm I use, is:

```
$<Inline Formula>$
```

This is actually a Shortcut of the Environment "math":

```
\begin{math}
   <Formula>
\end{math}
```

E.g

```
Tom noticed inside his Book the Formula
$\vec{x}=2\hat{i}+3\hat{j}$ which
was apparently something to do with
     Calculus.
```

which gives:

Tom noticed inside his Book the Formula $\vec{x}=2\hat{i}+3\hat{j}$ which was apparently something to do with Calculus.

Remark 42.3.1.1. You should use inline Formulas for short mathematical Expressions that prepare the Reader for the Introduction of a Formula.

42.3.2 Displayed Formulas

A **displayed Formula** is a mathematical Artifact that is used outside the ParagraphText, that is, between Paragraphs (unless otherwise specified). It is the most versatile Form of mathematical Artifacts. There are two versions of it:

1. Anonymous displayed Formula
2. Known displayed Formula, AKA Equation

42.3.2.1 Anonymous Displayed Formula

The anonymous displayed Formula is an Area where a Formula is displayed without any Reference. It is denoted as:

```
\[<Mathematical Formula>\]
```

An alternative Notation uses the double DollarSign:

```
$$<Mathematical Formula>$$
```

Both Notations are actually a Shortcut of the Environment "displaymath":

```
\begin{displaymath}
   <Formula>
\end{displaymath}
```

E.g. the first Notation:

```
\[\vec{x}=2\hat{i}+3\hat{j}\]
```

creates the mathematical Artifact:

$$\vec{x}=2\hat{i}+3\hat{j}$$

A Note here: while "Latex" allows you to make possible the writing of Formulas, it does not mean that the Perception of writing the Formulas is correct! the Formula given before, is written without the Points above "i" and "j". Consequently, the correct Way should be:

```
\[\vec{x}=2\hat{\imath}+3\hat{\jmath
    }\]
```

which leads to:

$$\vec{x}=2\hat{\imath}+3\hat{\jmath}$$

If you are working for an academic or industrial Organization, ask the Management for the proper Requirements (if they have any Process about it) in writing the Equations. The Reasoning behind it, is that they might use Software that translates "Latex"-Formulas to a "ComputerProgramming"-Code and in this erroneous Case, you might feed it Trash which cannot translate.

42.3.2.2 Equation

The "equation"-Environment displays a Formula with a known Number for Reference. To include a mathematical Equation use the following Format:

```
\begin{equation}
   <Label>
   <Definition of the equation>
\end{equation}
```

For example:

```
\begin{equation}
   \label{eq:Algebraic1}
   f(x)=(x+1)(x-2)
\end{equation}
```

will display:

$$f(x) = (x+1)(x-2)$$

Note: to display a Formula with the "equation"-Environment, but without the NumberingDisplay, use the Asterisk before the closing curly Brace and directly after the Word "equation". This Modification was shown in the Example, and will be shown but not denoted in the next Examples from now on.

42.4 Adjustments in Formulas

Formulas need also some Adjustments which (among others) are:

1. Labeling and Referencing an Equation
2. Annotating an Equation
3. Disabling the EquationNumbering
4. Horizontal Spacing
5. MultilineExpressions
6. Aligning
7. Cases
8. Resizing

I will treat now each Issue separately.

42.4.1 Labeling and Referencing an Equation

To label an Equation for referencing it, use the "label"-Command followed by a ReferenceName before or after the Expression.

E.g.

```
\begin{equation}
   \label{eq:Algebraic2}
   f(x)=(x+1)(x-2)
\end{equation}
```

will display:

$$f(x) = (x+1)(x-2)$$

which can be referenced as:

```
\ref{eq:Algebraic2}
```

where once implement will look as **??**.

42.4.2 Annotating an Equation

Annotating an Equation [1] means that we add a Word, Sentence or Commentary inside the Equation. This is done by including before the Expression a "\text" (or an "\mbox" for more Control) so that we can add the Text. Worth to know that inside the Commentary we can nest another Expression if we want to.

E.g. This Equation contains a primary Equation and a secondary Equation nested in the TextCommentary.

```
\begin{equation}
   f(x)=(x+1)(x-2),
   \text{ Roots are $(x_1, x_2)=(-1, +2)
        $}
   \label{eq:Algebraic3}
\end{equation}
```

will display:

$$f(x) = (x+1)(x-2), \text{ Roots are } (x_1, x_2) = (-1, +2)$$

Note: You can also add a ParagraphBox or a FrameBox or a Makebox. However, you must to know that if you do

[1] To annotate an inline Formula is not necessary, unless you include a very small Word such as "if".

this, the Equation, if follows, will be problematic to its Placement. To solve this, the "multline"-Environment from "amsmath"-Package is more appropriate.

42.4.3 Disabling the Numbering of an Expression

To suppress the Numbering on an Equation, use the AsteriskForm.

E.g.

```
\begin{equation*}
   f(x)=(x+1)(x-2),
   \text{ Roots are $(x_1, x_2)=(-1, +2)
        $}
   \label{eq:Algebraic}
\end{equation*}
```

will display:

$$f(x) = (x+1)(x-2), \text{ Roots are } (x_1, x_2) = (-1, +2)$$

42.4.4 Horizontal Spacing

For horizontal Spacing, the Commands "\quad" and "\qquad" insert a Space correspondingly of 1em or 2em in Text or MathMode.

E.g.

```
\begin{equation*}
   f(x)=(x+1)(x-2),\quad
   \text{Roots are $(x_1, x_2)=(-1, +2)$}
   \label{eq:Algebraic}
\end{equation*}
```

$$f(x) = (x+1)(x-2), \quad \text{Roots are } (x_1, x_2) = (-1, +2)$$

Other smaller Spaces are "\,", "\:", "\;".

42.4.5 MultilineExpressions

A MultilineExpression is one that extends a TextLine after TextLine, such as when having a mathematical Series. The "multline"-Environment of "amsmath"-Package provides such a Construction. Each LineBreak is provided by double Backslash, while also Annotations can be provided. It can also take "label"-Commands to refer to each Expression appearing on a TextLine. Note that the Equation is displaced on the Right with each LineBreak.

```
\begin{multline}
   Z{f[k]} =
      \sum^{\infty}_{X_{k}=0}{f[k]\cdot z
          ^k}\\
   \frac{1}{z}+\frac{1}{z^2}\\
   \frac{1}{z^3}+\dots
\end{multline}
```

which displays:

$$Zf[k] = \sum_{X_k=0}^{\infty} f[k] \cdot z^k$$
$$\frac{1}{z} + \frac{1}{z^2}$$
$$\frac{1}{z^3} + \dots$$

42.4.6 Splitted Expressions

A splitted Expression is one that extends an Expression directly under its TextLine, such as when having a long mathematical Series. The "split"-Environment of "amsmath"-Package provides such a Construction. Each LineBreak is provided by double Backslash, while also Annotations can be provided. Note that the Equation is not displaced on the Right with each LineBreak, unless the "Ampersand"-Symbol is used in such a Way as denoting a Separation on a particular Point of a TextLine.

E.g. In this Example the Ampersand aligns the EquationParts, while a Part without Ampersand will be shifted to the Left.

```
\begin{equation}
   \begin{split}
      Z{f[k]}  &=\sum^{\infty}_{X_{k}=0}{
          f[k]\cdot z^k}\\
      &=\frac{1}{z}+\frac{1}{z^2}\\
      \frac{1}{z^3}+\dots
   \end{split}
\end{equation}
```

which displays:

$$
\begin{aligned}
Zf[k] &= \sum_{X_k=0}^{\infty} f[k] \cdot z^k \\
&= \frac{1}{z} + \frac{1}{z^2} \\
&\frac{1}{z^3} + \dots
\end{aligned}
\tag{42.1}
$$

42.4.7 Aligning an Expression

To align an Expression means to set the ExpressionParts in a Form that will be visually as aligned as a Table. For this Reason we use two "Latex"-Operators, the & as ColumnAligner, and the double Backslash \\as a RowAligner. The "align"-Environment of "amsmath"-Package serves inside the Equation for the correct Alignment [2] . It can be annotated and also take "label"-Commands to refer to each Expression appearing on a TextLine. E.g. In this Example we have two Equations that are aligned on "less than equal"- and "equal"-Signs; there is also an Annotation.

```
\begin{align}
   f(x) &\leq x+2
      \quad\mbox{This is particular}\\
   g(x)+3 &= x-A
\end{align}
```

will display:

$$
\begin{aligned}
f(x) &\leq x+2 && \text{This is particular} \\
g(x)+3 &= x-A
\end{aligned}
$$

42.4.8 Cases of an Expression AKA conditional Expression

A Relation between two mathematical Objects can have Scenarios on the Way that the Objects relate; these Scenarios are called "Cases" and are considered under particular Values that Variables take.

[2] In the Past the "eqnarray"-Environment was serving this Purpose but the last 20 years is deprecated due to Compatibility- and DesignIssues.

Since Scenarios cover different Expressions for these particular Values, this Notation is indicated in Mathematics by a large curly Brace that encloses two or more Cases of a mathematical Object, such as a Function. To create two or more Cases, you must use the "cases"-Environment, as well as the Row- and ColumnOperators (\\and & respectively) for adjusting each Case. Note that the "cases"-Environment follows the mathematical Object itself, in Order to provide each Case. As usual, "label"-Commands, Annotations, and AsteriskForm of the "cases"-Environment are valid.

E.g.

```
\begin{equation}
   step(x) =
   \begin{cases}
      0, &\text{$x<0$}\\
      1, &\text{$x\geq 0$}
   \end{cases}
\end{equation}
```

will display:

$$
step(x) = \begin{cases} 0, & x < 0 \\ 1, & x \geq 0 \end{cases}
$$

42.4.9 Resizing an Expression

To resize an Expression, use the "scalebox"-Command to display a different CharacterSize. The Command has the Form for the inline Formula:

```
\scalebox{<Size>}{<Formula>}
```

For an "equation"-Environment, the Command has the Form:

```
\begin{equation}
   \scalebox{<Scaling-factor>}
   {<Expression>}
\end{equation}
```

E.g. To resize to one and half the inline Formula $(a+b)$:

```
This is the Expression
 \scalebox{1.5}{$(a+b)$} that I use.
```

will display:

This is the Expression $\scalebox{1.5}{$(a+b)$}$ that I use.

E.g. To resize to one and half a Formula for “equation”-Environment:

```
\begin{equation}
   \scalebox{1.5}{(a+b)}
\end{equation}
```

will display:

$$\scalebox{1.5}{(a+b)}$$

42.5 Mathematical Symbols and Notations

Having mentioned the FormulaConstructions previously, I intentionally avoided to describe Symbols and Notations. This was done due to the Illusion of mathematical Notation in Computing when a ComputerUser attempts to write Mathematics; there he faces two Problems, the one of writing the correct Notation and the second of mapping his Ideas into a mathematical Construct, perhaps even an Algorithm. The Illusion here, is what he wants to write, what the Notation is, and how he wants to map it and not to forget his previous Experience with mathematical Computing where he might have a different Notation in Mind.

42.5.1 Binary operators

Binary Operators are those that involve two Operands. The MinusSign is also used as a unary Operator. The NOT-Operator is a unary Operator found in Expressions, I didn’t want to give this Bastard his own EditingSection. See in any Case, 42.1.

E.g.

```
\begin{displaymath}
   y=a + b
\end{displaymath}
```

will display:

$$y=a + b$$

Symbol	TEX	Meaning
+	$+$	Plus
−	$-$	Minus
±	$\pm$	PlusMinus
×	$\times$	multiply by
÷	$\div$	divide by
∗	$\ast$	Asterisk
⋆	$\star$	Star
·	$\cdot$	Centre dot
∨	$\lor$	Logical OR
∧	$\land$	Logical AND
∧	\land	Logical AND

Table 42.1: The Symbols of binary Operators.

42.5.2 Fractions

A Fraction is a Part of the Whole consisting of two Numbers, the Part called the Numerator and the Whole which is called Denominator and *Denominator is regarded in an Amount of Parts.* Both Numbers separated by a horizontal Line, with the Denominator below it. To denote a Fraction in “Latex”, use the Form:

```
\frac{<Numerator>}{<Denominator>}
```

E.g.

```
\begin{displaymath}
   \frac{x+1}{x-2}=f(x)
\end{displaymath}
```

will display:

$$f(x)=\frac{x+1}{x-2}$$

42.5.3 Delimiters

A Delimiter is a Symbol used to separate an Expression from another Expression, mostly used for couplewise Operations. It

serves as a Tool of Separation of Concerns as well as a Tool for HierarchyDemonstration (Order of Evaluation). Though every Symbol can be used as a Delimiter, there are three basic Delimiters [3] :

1. The ParenthesisPair, ( )
2. The "SquareBrackets"-Pair AKA BracketsPair [ ]
3. The "curly Brackets"-Pair AKA BracesPair, { } [4]

The DelimiterSize is not dependent on the ExpressionSize, and thus, you must force its Implementation with \left and \right.

Using the Delimiters is easy on one LineExpressions.

E.g.

```
\begin{displaymath}
   y=\{[(a+b) \cdot (c-d)]\cdot (f/g) \}
\end{displaymath}
```

Will display:

$$y = \{[(a+b) \cdot (c-d)] \cdot (f/g)\}$$

An additional Command for Delimiter, is one that uses the "\left"- and "\right"-Commands as a Mean to adjust the Size of Delimiters. However these Commands should be used in Pair, and if one Delimiter is not used, then add to these Commands a CharacterPeriod, ".", e.g. "\left}.".

E.g.

```
\begin{displaymath}
   y= \left\{ \frac{a+b}{c-d}\right\} \
        cdot (f/g)
\end{displaymath}
```

Will display:

$$y = \left\{ \frac{a+b}{c-d} \right\} \cdot (f/g)$$

[3] Actually exists more than three DelimiterTypes, but lets learn to walk before we learn to run.

[4] An alternative of this is "\lbrace" and "\rbrace". While it might seem long, you must to understand that in TextSearching, is more easy to locate such Braces than their short Form.

42.5.4 Accents

Accents are called these special Symbols that denote a Property that applies to a Variable. They are most commonly the following, see 42.2:

Symbol	TEX	Meaning
$\acute{a}$	`$\acute{a}$`	Acute (Derivative)
$\dot{a}$	`$\dot{a}$`	Dot (Time-derivative)
$\ddot{a}$	`$\ddot{a}$`	Double dot (Second time-derivative)
$\hat{a}$	`$\hat{a}$`	Hat (VectorCalculus)
$\tilde{a}$	`$\tilde{a}$`	Tilde (Phasors)
$\bar{a}$	`$\bar{a}$`	Bar (Alcohol among Others☺)
$\vec{a}$	`$\vec{a}$`	Vector
$\imath$	`$\imath$`	Imaginary i
$\jmath$	`$\jmath$`	Imaginary j

Table 42.2: The Symbols of mathematical Accents..

42.5.5 Subscripts and Superscripts

A **Subscript** is a smaller sized Text attached to a larger sized Text, after it and below it.

E.g. t_{G3}, where the "t"-Character has the Subscript "G3".

Typically a Subscript is used to provide a specific Identity (not a *mathematical Identity*), to a named Object.

E.g. Let the Object "Time", denoted as **t**, and a specific Instant of Time denoted as t_1.

To denote Subscripts use the Form with Underscore and optionally a BracesPair:

```
$Object_{<Identity>}$
```

E.g.

```
$x_{Row}$
```

Will display:

x_{Row}

Sometimes a Subscript under a Subscript is needed. This is done by Nesting.

E.g.

```
$G_{x_{12}}$
```

Will display:

$G_{x_{12}}$

A Superscript is a smaller sized Text attached to a larger sized Text, after it and above it.

E.g. t^{G3} where "t"-Character has the Superscript "G3". It is typically used to denote an Exponent, i.e. a Shortcut to a larger Product of the same Value. E.g. x^5 which is a Shortcut of the Expression $x \cdot x \cdot x \cdot x \cdot x$.

To denote Superscripts use the Form:

```
$Object^{<Exponent>}$
```

E.g.

```
$x^{y+1}$
```

Will display:

x^{y+1}

Sometimes a Superscript over a Superscript is needed. This is done by Nesting.

E.g.

```
$x^{(y+1)^{H}}$
```

Will display:

$x^{(y+1)^{H}}$

Finally a mixed Notation of Superscript and Subscript is often encountered, with either Superscript or Subscript coming first without Loss of Meaning

E.g.

```
$x^{G}_{time}$
```

Will display:

x^{G}_{time}

The mixed Notation can have Nestings of Superscripts inside Subscripts and vice versa. In this case is strongly recommended larger CharacterSize, so that the Formula is properly displayed, otherwise they will consider you as a fake Name for me and you'll get into Problems. Perhaps Asylum, even worst, Lobotomy.

E.g.

```
Let the People believe that
\scalebox{2.3}{$ { x^{G_{Color}}_{time^{
    Vectorial}} }$}
is right.
```

Will display:

Let the People believe that $\scalebox{2.3}{$ { x^{G_{Color}}_{time^{Vectorial}} }$}$ is right.

Note: there are Packages for even better Display of Superscripts and Subscripts. Here you learn only the Basics.

42.5.6 Matrices and Determinants

Matrices and Determinants are displayed in "Latex" using various Forms of the "matrix"-Environment. There are three Forms for Matrices now due:

1. Matrix without Brackets
2. Matrix with Brackets denoted by "\left"- and "\right"-command.
3. Matrix with Bars or Brackets

The Matrix has the following main Controls:

1. A ColumnSeparator indicated by \&
2. A RowSeparator indicated by twice the Backslash \\.

Its Form is generally speaking:

```
\begin{displaymath}
   \begin{matrix}
      <Matrix elements>
   \end{matrix}
\end{displaymath}
```

42.5.6.1 Matrix without Brackets

This environment has the name "matrix". An example of this is the 2 by 3 Matrix, shown next:

```
\begin{displaymath}
   \begin{matrix}
      a &2 &5\\
      b &x+3 &8
   \end{matrix}
\end{displaymath}
```

Which will be displayed as:

$$\begin{matrix} a & 2 & 5 \\ b & x+3 & 8 \end{matrix}$$

This is an ugly Form to the untrained Eye but we can equate it to the Matrix-Name, by equating the Environment itself to the MatrixName.

E.g.

```
\begin{displaymath}
   A = \begin{matrix}
      a &2 &5\\
      b &x+3 &8
   \end{matrix}
\ end{displaymath}
```

Will display:

$$A = \begin{matrix} a & 2 & 5 \\ b & x+3 & 8 \end{matrix}$$

A Lesson here is due: **when we have Matrices to add, we must to use so many "matrix"-Environments as the Matrices**. Just place a Matrix after a binary Operator.

E.g.

```
\begin{displaymath}
   A + A =
   \begin{matrix}
      a &2 &5\\
      b &x+3 &8
   \end{matrix} +
   \begin{matrix}
      a &2 &5\\
      b &x+3 &8
   \end{matrix}
\ end{displaymath}
```

which displays:

$$A + A = \begin{matrix} a & 2 & 5 \\ b & x+3 & 8 \end{matrix} + \begin{matrix} a & 2 & 5 \\ b & x+3 & 8 \end{matrix}$$

42.5.6.2 Matrix with Brackets denoted by "left"- and "right"-Commands

We can have Matrices with mixed or defined Delimiters, by using before the "matrix"-Environment the "left"- and "right"-Commands. Just after the Commands add the Delimiters you need.

```
\begin{displaymath}
   A = \left[
   \begin{matrix}
      a &2 &5\\
      b &x+3 &8
   \end{matrix}
   \right]
\end{displaymath}
```

will display:

$$A = \left[\begin{matrix} a & 2 & 5 \\ b & x+3 & 8 \end{matrix} \right]$$

42.5.6.3 Matrix with Bars

A Matrix with Bars, has the "matrix"-Environment "vmatrix" ("v" for vertical). It can be used to display Determinants.

E.g. Display a 3 by 3 Determinant:

```
\begin{displaymath}
   Det(B) = \begin{vmatrix}
      7 &3 &2\\
      8 &4 &-5\\
      9 &3 &4
   \end{vmatrix}
\end{displaymath}
```

Will display:

$$Det(B) = \begin{vmatrix} 7 & 3 & 2 \\ 8 & 4 & -5 \\ 9 & 3 & 4 \end{vmatrix}$$

42.5.6.4 Matrix with Brackets or Parenthesis

Using the Package "amsmath", a Matrix with Brackets, has the "bmatrix"-environment, while a Matrix with Parenthesis, has the pmatrix-environment.

E.g. Matrix with Parenthesis

```
\begin{displaymath}
   \begin{pmatrix}
      4 &5\\
      4 &3
   \end{pmatrix}
\end{displaymath}
```

will display:

$$\begin{pmatrix} 4 & 5 \\ 4 & 3 \end{pmatrix}$$

E.g. A Matrix with Brackets:

```
\begin{displaymath}
   \begin{bmatrix}
      7 &3\\
      8 &4
   \end{bmatrix},\
\end{displaymath}
```

will display:

$$\begin{bmatrix} 4 & 5 \\ 4 & 3 \end{bmatrix}$$

42.5.7 Relations

Relations are Objects that compare Objects according to a Context. Here I provide a Table [5] with the most common Relations in 42.3. This Catalog in not strictly relational according to the RelationAspects.

42.5.8 Sets

Here is the most common Notation used in SetsTheory, see Table 42.4.

42.5.8.1 Sets of Numbers

A Set of Numbers is a Collection of Values that are used as a Resource to build something or exhibited as Values of a mathematical Function. I will display the Sets of Numbers with the Package "amsfonts", which has nice Fonts for the basic Sets. Your Sets will be usually denoted in SetNotation. See 42.5.

[5] **with four Feet, seeing the Mediterranean Sea, while a Breeze keeps you fresh together with the one you love and you now share a Glass of Wine.** One of the Glasses is poisoned.

Symbol	TEX	Meaning
$=$	`$=$`	Equals
$\propto$	`$\propto$`	Proportional
$\therefore$	`$\therefore$`	Therefore
$\because$	`$\because$`	Because
$\geq$	`$\geq$`	Greater than or equal
$>$	`$>$`	Greater than
$\leq$	`$\leq$`	Less than or equal
$<$	`$<$`	Less than
$\approx$	`$\approx$`	Approximate to
$\equiv$	`$\equiv$`	Equivalent to
:	`$\colon$`	Colon in mapping relation

Table 42.3: The Symbols of mathematical Relations.

Note that the Term "irrational" does not mean illogical (this is assumed as "crazy") but simple not rational i.e. not written as a Ratio, i.e. as a Fraction.

42.5.9 Radicals and Roots

An Interpretation of a Radical is that is the Symbol $\surd$ and an Interpretation of Root is a Value obtained from a Radical, such as $\sqrt{2}$, see [James] for his Interpretation of Term. Concerning "Latex", the Radical is created by using the "\surd"-Command, while the Root is created by using the "\root"-Command. Note that the Radical does not have a long Bar, while the Root has. Consequently the Root is more appropriate for long Expressions.

E.g. $\surd{3}$ is made of `$\surd{3}$`
E.g. $\sqrt{3}$ is made of `$\sqrt{3}$`
E.g. $\sqrt{5-x}$ is made of `$\sqrt{5-x}$`

An alternative Option for the Root is that the "\root"-Command can take an optional Argument to define the Magni-

Symbol	TEX	Meaning
$\in$	`$\in $`	belongs to
$\notin$	`$\notin$`	does not belong to
$\subset$	`$\subset$`	proper Subset of
$\nsubset$	`$\nsubset$`	See “not Subset of’
$\subseteq$	`$\subseteq$`	Subset of
$\nsubseteq$	`$\nsubseteq$`	not Subset of. Package“amssymbols”
$\cup$	`$\cup$`	Union of
$\cap$	`$\cap$`	Intersection of

Table 42.4: The Symbols of mathematical Sets.

Symbol	TEX	Meaning
$\mathbb{N}$	\mathbb{N}	Natural Numbers
$\mathbb{Z}$	\mathbb{Z}	Integers
$\mathbb{Q}$	\mathbb{Q}	Rational Numbers
$\mathbb{R}$	\mathbb{R}	Real Numbers
$\mathbb{C}$	\mathbb{C}	Complex Numbers
$\mathbb{I}$	\mathbb{I}	Irrational Numbers

Table 42.5: The Sets of Numbers.

tude of the nth Root. Since a SquareRoot has the Magnitude “2” then for $x \in R^+$ exists $\sqrt{x} = \sqrt[2]{x}$ I can write for the Root:

`$\sqrt[<nth Root>]{Value}$`

E.g. $\sqrt[3]{5-x}$ is made of `$\sqrt[3]{5-x}$`.

42.5.10 Calculus symbols

CalculusSymbols are available in “Latex”. There are most commonly three Symbol-Categories:

- Limits of Functions
- Derivatives
- Integrals

The **Limit** is provided by the “\lim”-Command that takes a Subscript:

```
Limit of f(x) as x tends to Infinity:
   $\lim_{x \to \infty} f(x)$
```

which gives:

Limit of f(x) as x tends to Infinity: $\lim_{x \to \infty} f(x)$

The **Derivative** can be provided by the Prime- as well as the FractionSign:

```
Differentiation, PrimeSign: $y'(x)$
Differentiation, FractionSign: $\frac{df(
    x)}{dx}$
```

which gives:

Differentiation, PrimeSign: $y'(x)$

Differentiation, FractionSign: $\frac{df(x)}{dx}$

The **Partial Differentiation of VectorField** “V” with respect to Variable “x” is provided by the “\partial”-Command that can take as Argument an Expression:

```
Partial Differentiation:
   $\frac{\partial{\vec{V}}}{\partial{x
       }}$
```

which gives:

Partial Differentiation: $\frac{\partial \vec{V}}{\partial x}$

The **Integral of a Function** is provided by the “\int”-Command that takes a Subscript and a Superscript.

```
Integral of f(x) with respect to x:
   $\int_{b}^{c} f(x)\, dx$
```

which gives:

Integral of f(x) with respect to x: $\int_b^c f(x)\, dx$

The `\,` provides a small Blank between “f(x)” and “dx”, and I tracked this on [Kopka et al] [6] . Some Users [Oetiker et al] [7] create a Command for this `\newcommand{\ud}{\,\mathrm{d}}` to add a Blank between “f(x)” and “dx”.

[6] [Kopka et al]: Kopka, H, Daly, P. A guide to LATEX : document preparation for beginners and advanced users. Pearson Education Ltd, Great Britain, 1999

[7] Oetiker, T, Partl, H, Hyna I, Schlegl, E. The Not So Short Introduction to LATEX2. Version 5.06, June 20, 2016

42.5.11 Geometrical Notation

Geometrical Notation deals with the Artifacts that represent geometrical Objects in a TextLine.

E.g. Triangle "BCD" is congruent with Triangle "EFG" is represented as $\triangle BCD \cong \triangle EFG$.

In Table 42.6 exists the most common Examples of geometrical Notation.

42.6 Proclamations and Proofs

42.6.1 Proclamations

In a technical Document frequently arises the Need to formally present metalinguistic Concepts such as Declarations and Definitions as well as descriptive Elements such as Axioms, Theorems and the "Like". All these Declarations are called **Proclamations**.

A Proclamation is a formal Announcement about something:

Def. 42.6.1.1*:* **Proclamation:** is a formal Announcement about an Event or Item

In Mathematics a Proclamation is an Announcement about a Part of Research.

Def. 42.6.1.2*:* **Proclamation (Mathematics):** is a formal Announcement of an Aspect of mathematical Endeavor.

Remark 42.6.1.1. Proclamations in Mathematics are: Axioms, Theorems, Theories, Corrolaries, Lemmas, Remarks among others.

In order to accommodate this Demand, the **American Mathematical Society** devised a StatementStructure via the "\newtheorem"-Command which is included in the Package "amsthm". This Structure creates an Environment where Theorems, Corollaries, Lemmas and other Proclamations can be declared and used. There are three Ways to create such Proclamations:

1. Create your Command for a Proclamation together with a Counter for each actual Proclamation created.

2. Declare a Proclamation together with some Reference within the Document based on a "Latex"-Package.

3. Declare your Command and the "Latex"-Package Proclamation [8]

The first Situation can be done, but it eventually be loss of Time. The second Option is the most common and most of People will use it. The third Option is a little bit more complex and is part of this Document. I provide here the second and the third Option.

42.6.2 Declaring the Proclamation

Use the "newtheorem"-Command with Arguments the Names of Proclamations:

```
<Create a Proclamation>:=
   \newtheorem{<ProclamationName>}
      {<Caption>}[<ParentCounter>]
```

The ProclamationName is something problematic since can cause Peculiarities to many "TextProcessing"-Systems [9] In most Cases you will see the ProclamationName to be the same Name with the Proclamation itself and only Difference is the lowercase Character, e.g. "theorem" for ProclamationName and "Theorem" for the Caption. It is preferable by my Experience ("long Time"-Idiot) to use the Name of Proclamation preceded by a small

[8] ...so that there is an easier Shortcut especially for the Nights that your Sailor is on BusinessTrip and you miss his strong Arms that surround you and tell you "Joe I miss you. Me to Carter".

[9] The Situation might seem easy enough for the User, but the Context of a SourceCode such as "Latex" can cause Problem to the Interpretation of the Tex by an AI-System. During my ProgrammingTraining -I was young! I didn't know!☺- I still remember the Professors falling to the Traps of Language and Metalanguage and these people were Professionals. In their Credit they were trying to teach an Idiot! (i.e. the Author)

Acronym like x or the Acronym of your Name, for example CN for Proclamation-Name Theorem will be “cntheorem” while the caption will be “Theorem”.

The “Caption” is what will appear once the Theorem is invoked. The “Parent-Counter” is a simple Mechanism that binds the Proclamation to the Area of the Document that the Proclamation refers. By Default, that is, without Declaration, the Proclamation will get a value irrespective of the DocumentPart. If you declare the ParentCounter to be “chapter”, then the Proclamation will refer with two Values, the ChapterNumber and its Value. If you declare the Proclamation with Parent-Counter to be “section” then the Proclamation will come with three Values, the Chapter, the Section and its Value.

E.g Creating the Proclamation for a Theorem will be like:

```
\newtheorem{StrayCats}{Theorem}[
    subsection]
```

which will display:

Theorem: 42.6.2.1. The stray Cats are everywhere.

42.6.3 Using the Proclamation

To use the Proclamation use the “Proclamation”-Environment:

```
\begin{<ProclamationName>}
   [<Optional Name for Proclamation>]
   <ProclamationParagraph>
\end{<Proclamation-Name>}
```

E.g.

```
\newtheorem{Tits}{Theorem}[subsection]
...
\begin{Tits}[Abuse theorem of mathematics
   by Neufelt Christopher]
   Every Abuse of Mathematics is
       inversely
   proportional to the Intention of the
   mathematician to help the Progress
   of Mathematics.
\end{Tits}
```

This will display as:

Theorem 42.6.3.1 (Abuse theorem of mathematics by Neufelt Christopher). Every Abuse of Mathematics is inversely proportional to the Intention of the mathematician to help the Progress of Mathematics.

By the Way I haven’t got a Clue how I created this Theorem in a few Seconds, but now that I look at this, it reminds me the famous Proverb, “The Road to Hell is paved with good Intentions”.

42.6.4 Common types of Proclamations

There are many types of Proclamations used in technical Documentation, the most common are:

- Definitions
- Theorems
- Theories
- Postulates
- Axioms
- Principles
- Laws
- Rules
- Corollaries
- Remarks
- Lemmas
- Proofs

The “amsthm”-Package provides a separate Environment for the Proofs that I will explain next.

Within Proclamations there are different Styles that you must to denote before you use. These are:

- **plain**: this applies to Theorem, Lemma, Corollary, Proposition, Conjecture, Criterion, and Assertion.

- **definition**: this applies to Definition, Condition, Problem, Example, Exercise, Algorithm, Question, Axiom, Property, Assumption and Hypothesis.
- **remark**: this applies to Remark, Note, Notation, Claim, Summary, Acknowledgment, Case and Conclusion.

As you write a Proclamation, precede it with the Command "\theoremstyle":

```
\theoremstyle{plain|definition|remark}
```

before the Declaration.

42.6.5 Proofs

The "asmthm"-Package has also a "proof"-Environment to (ab)use. This is declared as:

```
\begin{proof}
   <Mathematical Content>
   \textbf{Q.E.D.}
\end{proof}
```

Within, the "\proof"-Command attach the Acronym of **"Quod Erat Demonstrandum"** at the Point of Proof you regard as the End of the Proof.
E.g.

```
\begin{proof}
    write here the Proof
   \textbf{Q.E.D.}
\end{proof}
```

will give:

Proof. write here the proof **Q.E.D.** □

Note that there is the "qedhere"-Command which I don't use, since it displays the square Sign. I am more Traditionalist and I use a **Q.E.D.**.

Symbol	TEX	Meaning
$B\bullet$	`$B \bullet$`	Point “B”
$\overleftrightarrow{BC}$	`$\overleftrightarrow{BC}$`	Line including Points “B” and “C”
$\overline{BC}$	`$\overline{BC}$`	Straight (Line-) Segment with End-Points “B” and “C”
$\overrightarrow{BC}$	`$\overrightarrow{BC}$`	Ray with EndPoint “B” and Point “C” included within the Line
$\overline{BC} \parallel \overline{DE}$	`$\overline{BC} \parallel \overline{DE}$`	Straight Segment “BC” parallel to straight Segment “DE’
$\overline{BC} \nparallel \overline{DE}$	`$\overline{BC} \nparallel \overline{DE}$`	Straight Segment “BC” not parallel to straight Segment “DE”
$\overline{BC} \perp \overline{DE}$	`$\overline{BC} \perp \overline{DE}$`	Straight Segment “BC” perpendicular to Straight Segment “DE”
$\angle B$	`$\angle B$`	Angle “B”
$\triangle BCD$	`$\triangle BCD$`	Triangle with Vertices “B”, “C” and “D”
$\triangle BCD \cong \triangle EFG$	`$\triangle BCD \cong \triangle EFG$`	Triangle “BCD” is congruent with Triangle “EFG”
$\triangle BCD \ncong \triangle EFG$	`$\triangle BCD \ncong \triangle EFG$`	Triangle “BCD” is not congruent with Triangle “EFG”
$\odot B$	`$\odot B$`	Circle “B” with “B” either the Circle as Shape or “B” as CircleCenter
$\circledS B, C, D$	`$\circledS B, C, D$`	Circles “B”, “C” and “D”

Table 42.6: Symbols of geometrical Notation on TextLine

Chapter 43

Graphs with pgfplots

Narrative

A Plot is a piece of Land, usually small in Size that someone uses for Agriculture or related Tasks to "Digging" [1] . The Term "Plot" has been taken by Mathematics to describe a Place where Data can be allocated at specific Positions and estimated according to a given Pattern. In this Sense:

Def. 43.0.0.1*:* **Plot (Mathematics):** is a Representation of Data with their Relations as Part of a spatial Placement that follows some agreed Rules as well as graphical Requirements.

Needless to say that mathematical Equations are used to describe the "Cause and Effect"-Relations and as such can be placed graphically in a Plot:

Remark 43.0.0.1. Remember at all Times, that a Plot no Matter how complex it seems, always describes a causal Relation, even if there is only a spatial Representation of Data.

For a causal Relation an independent Variable serves as Cause, and the dependent Variable as an Effect.

Under the Technology of **"Tikz"-GraphicsSystem**, there is the "Latex"-Package called **"pgfplots"** from **Dr. Christian Feuersänger** [2] that provides a Library of Plots to satisfy even the most perverse Demands of a Mathematician [3] . Saying that, you will rarely need the Package in its full Glory, and here I describe only the Basics, just for you to get the Presentation [4] .

43.0.1 Frequents Terms on Plots

A Plot has many Terms that need to be clarified before they are addressed during its Design and Development. These are most commonly:

- CoordinatesSpace
- Axes
- AxesLabels
- Title
- Point
- Curve
- Tick
- Grid

[1] E.g. bury the Bodies

[2] See Dr. Christian Feuersänger. Manual for Package pgfplots 2D/3D Plots in LATEX, Version 1.18.1 in http://sourceforge.net/projects/pgfplots. If you meet him, give him a Hug from me.

[3] ...or Swindler! As Mark Twain accurately noted, "*There are Lies, big Lies and Statistics*". Scientifically Graphics can be used for professionally lying, and there is even a Book about it: **How to lying with Statistics** by **Darrell Huff**.

[4] , then embezzle the Funds and disappear in Amazon together with your SexSlaves of your Cult. All Hail the Messiah!

- Domain
- Range
- Style
- Path
- Samples
- Colormap

An Explanation of the Terms need to be made.

Def. 43.0.1.1*:* **CoordinatesSpace (PGF):** is an orthogonal rectangular or cubic Space where the Data can be placed.

This Space is an FantasyLocation that is graphically designed to accurate describe metrically the Relations of Data [5] .

Def. 43.0.1.2*:* **Axes (PGF):** are either two or three perpendicular RealLines that accomodate metric References to the Location of Data.

Def. 43.0.1.3*:* **AxesLabels (PGF):** are either two or three Labels attached to each Axis to denote what Data each Axis represents.s

Def. 43.0.1.4*:* **Title (PGF):** is a very short Description of the Data represented in the Plot.

Def. 43.0.1.5*:* **Mark AKA Point (PGF):** is a geometrical Point representing the Location associated with a Datum.

For the Clarification, a Datum can be a single, dual or more Aggregation of Data.

Def. 43.0.1.6*:* **Curve (PGF):** is a Line defined by the Interpolation of Poings generated by an Equation.

[5] Whether this CoordinatesSpace is in your Head or on Paper or ComputerScreen, your Doctor can answer us. We will be honestly surprised if you can.

The Curve can be Curve or Line. The name "Curve" is very common to mean "Line" but please call it as the SoftwareEngineer called it; to retain and understand a Term in TechnologyIndustry is important.

Def. 43.0.1.7*:* **Tick (PGF):** is a Stroke perpendicular to the RealLine and serves as a graphic Separator to discriminate the Location of Numbers associated with the Line's Length.

Def. 43.0.1.8*:* **Grid (PGF):** is a rectangular Division of Space serving as Locator of Data.

A grid is typically in a light Color comparing to the Axes.

Def. 43.0.1.9*:* **Domain (PGF):** is a Set of numerical Values that serve as the numerical Bounds of the independent Variable.

Def. 43.0.1.10*:* **Range (PGF):** is a Set of numerical Values that serve as the numerical Bounds of the dependent Variable.

Def. 43.0.1.11*:* **Style (PGF):** is an Element of Graphic Design that gives a different aesthetic Interpretation to the graphic Problem.

E.g. A Font can have a Style to give a certain "Feeling" on the Sentence described.

Def. 43.0.1.12*:* **Path:** is a straight Line that connects two Points.

Def. 43.0.1.13*:* **Samples:** is the Amount of Data that allowed to be depicted on the Plot.

Def. 43.0.1.14*:* **ColorMap:** is a straight Strip that describes a ColorSpectrum.

A ColorMap can have an Association of Numbers, but in any Case, the Colors of Data are associated with the ColorMap to

indicate additional Properties that are difficult to describe positionally on the Plot.

in Figure 43.1 the Names of the most common Artifacts are displayed.

43.1 Keys and Styles

As always, the “Latex”-Editor issues Commands into his Document. Many Commands have Settings to suit the CommandCustomization and these Settings are controlled by minor Commands called “Keys”. The Commands have also specific Styles that can be applied to them. An Example [6] of an “Enviroment” holding the Command to create an axial System with particular Key for a Grid in the Color “Orange” is shown here:

```
\begin{axis}[
   title={The Cartesian CoordinateSystem
       },
   grid style={color=orange},
   grid]
\end{axis}
```

In this Example the “Keys” are called “title” and “grid”, while a “style” for “grid” is declared as shown, enclosed in Braces and has the Form:

```
<KeyStyle>:=
   <Key> style"={"<StyleKeys>"}"
```

43.2 PlotTypes according to input of Data

There are many PlotTypes but the Creators of the “pgfplots” described the Plots according to the feeding of Data. There are four PlotTypes:

- **Plot of Function**: this Plot receives a mathematical Expression and displays it as Plot.
- **Plot of Coordinates**: this Plot receives a Tuple or a Triplet of Data and displays it as a Plot.
- **Plot of Table**: this Plot receives a DataFile and displays it as a Plot.
- **Plot of parametric Equations**: this Plot receives two or three parametric Expressions and displays it as a Plot.

The PlotTypes are implemented further.

43.3 PlotStructure

The PlotStructure in “Latex” has the following Form of Declarations:

1. Preamble
2. Setting the Plot in a correct Location within the Document
3. Setting the “tikz”-Figure
4. Axial Framework for the Plot
5. Mechanism for Plotting
6. Additional Settings

All these Aspects will be discussed in the Examples following.

43.3.1 Preamble

The Preamble consists of the “pgfplots”-Package as well as the additional Libraries according to the DrawingDemands. The Framework is added to the StylesFile where you have your other Packages. This is listed as:

```
\usepackage{pgfplots}
\usepgfplotslibrary{<Library>}
```

Where:

```
<Library>:=
   <LibraryNameList>|<LibraryName>
```

[6] This Example does not produce anything, since it needs additional elements. Move on.

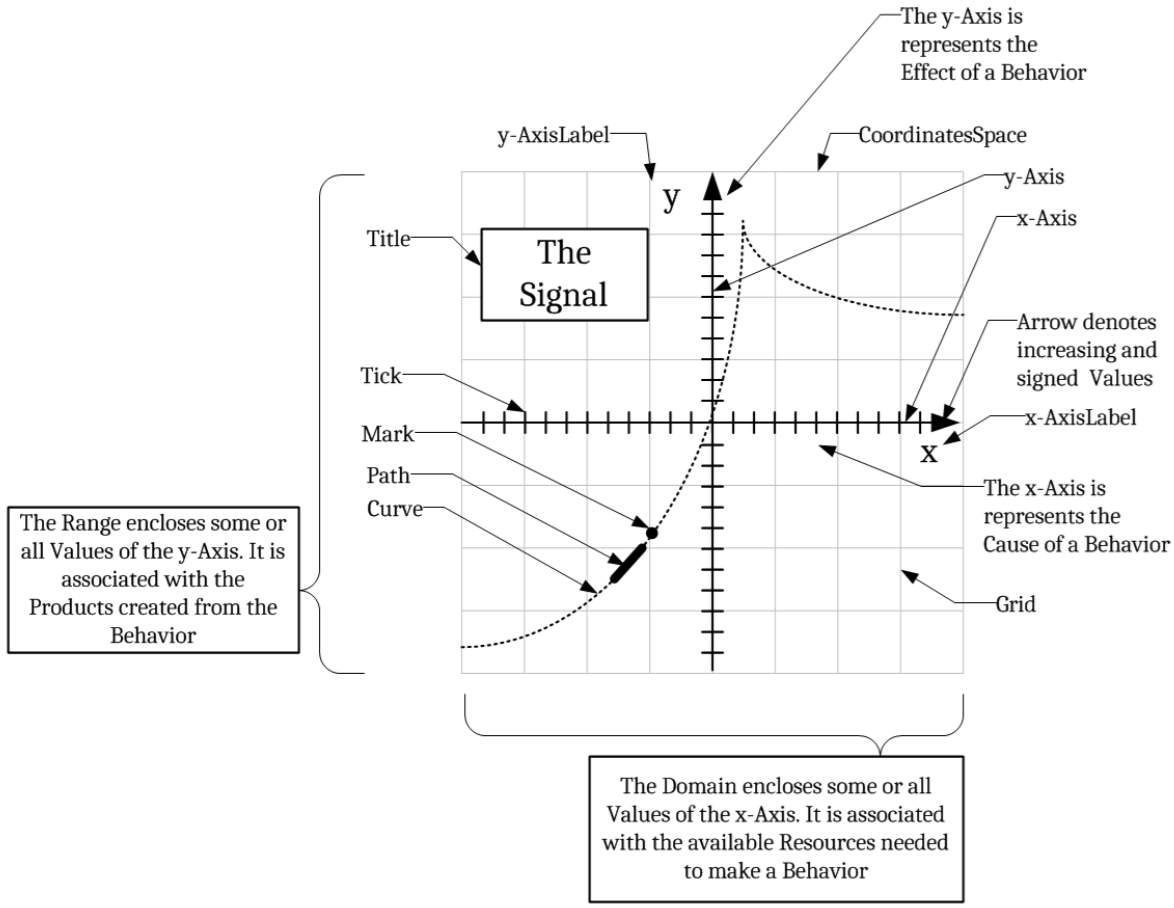

The y-Axis is represents the Effect of a Behavior
y-AxisLabel
CoordinatesSpace
y
y-Axis
x-Axis
Title
The Signal
Arrow denotes increasing and signed Values
Tick
Mark
x-AxisLabel
x
Path
Curve
The x-Axis is represents the Cause of a Behavior
Grid
The Range encloses some or all Values of the y-Axis. It is associated with the Products created from the Behavior
The Domain encloses some or all Values of the x-Axis. It is associated with the available Resources needed to make a Behavior

Figure 43.1: Notation of CoordinatesSystem.

43.3.2 Colors and pgfplot

The "pgfplot" may use the "xcolor"- or "RGB"-ColorSet. The "xcolor"-Package defines the following Colors: **black, blue, brown, cyan, darkgray, gray, green, lightgray, lime, magenta, olive, orange, pink, purple, red, teal, violet, white, yellow**. The "RGB"-ColorSet is a Triplet of three Numbers defining the Red, Green and Blue. There are TuningOptions for creating a specific Color using "xcolor"-Names and these are coming from the following Coding:

```
color = <ColorName>["!"<Percentage of
    First Color>"!"<ColorName>]
```

E.g. `color = blue!40!green`

E.g. Actually in my Drawings I use as Grid the following Combination:

`color = orange!40!white`

Sometimes there is a Need for RBG-Color since a Publisher demands it. The Code in this Case can be defined as:

`rgb=(<R>,<G>,<B>)`

where the "RGB"-Colors are each Defined as a decimal Point Number between $[0, 1]$ found by the Ratio of an unsigned 8-Bit decimal Value that belongs to the Range of $[0, 255]$ defined as Intensity and divided by 255.

E.g the "latexcolors"-Package defines

the Color “aquamarine” as

```
\definecolor{aquamarine}{rgb
    }{0.5,1.0,0.83}
```

This is made by the IntensityVariants of the Channels $R = 127/255$, $G = 255/255$ and $B = 211/255$. The three Channels of Red, Green, Blue, their IntensityVariants and the additive Color of Aquamarine are shown in the Figure 43.2.

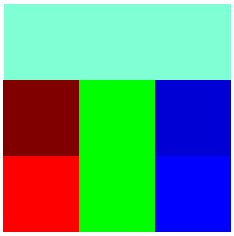


Figure 43.2: The three ColorChannels, their IntensityVariants and the additive Color of Aquamarine.

We can copy these Values as `rgb=(0.5, 1.0, 0.83)`.

However there is also the Switch `rgb255=(<R>,<G>,<B>)` which access some Commands and takes Values between $[0, 255]$. Concerning the aquamarine Color we have: `rgb255=(127, 255, 212)`

43.4 The Plot as Figure

Typically we enclose the “tikz”-Picture inside the “Figure”-Environment where the Caption and the Label of the Figure follow:

```
\begin{figure}
   \centering
   \begin{tikzpicture}
      <Code for "pgfplots"-Plot>
   \end{tikzpicture}
   \caption{<Text>}
   \label{fig:<Name>}
\end{figure}
```

A Plot in the Sense of the “pgfplots”-Package is a “tikz”-Figure. The correct Location of any Plot is within Text, but the “tikz”-Pictures can be everywhere.

43.5 The axial Space

We can speak of CoordinatesSpace when we relate Data allocated in a Space of a ReferenceSystem such as the Cartesian CoordinateSystem. Concerning the actual Use and Settings of the Axes appearing in a Plot, we speak of **axial Space** [7] .

In this sense we need to establish an “Axis”-Environment where the Settings of each Axis can be set and the Plot takes Place. The “Axis”-Environment is declared as:

```
\begin{axis}[<Settings>]
   <Actual Plot>
\end{axis}
```

Within the Framework of the complete Plot this is described as:

```
\begin{figure}
   \centering
   \begin{tikzpicture}
      \begin{axis}[<Settings>]
         <Actual Plot>
      \end{axis}
   \end{tikzpicture}
   \caption{<Text>}
   \label{fig:<Name>}
\end{figure}
```

There are actually different Types of axial Systems for Plots, the most common are **“Cartesian”, “logarithmic” and “polar”**. For the Cartesian the Environment is called “axis”, for the logarithmic are two “semilog”-Enviroments, the “semilogxaxis” and the “semilogyaxis”, while exists the “loglog”-Environment under the Name “loglog”. Finally the polar System, which its Environment is called “polaraxis”. More on these Environments on the Examples.

43.6 TextMath: Text and mathematical Expressions in a Plot

In a Plot there is a Demand to have Text as well as mathematical Expressions; this is

[7] This is a Term found in ComputerGraphics.

achieved by having Braces enclosing Text and inline Equations. For Brevity, I declare this only here as "TextMath" and is written as:

```
TextMath:=<Text>|<LatexMathematical
    Expression>|<Both>
```

where

```
Text:=<Text>
```

and

```
<LatexMathematical Expression>|<Both>:=
   "="{<Text>|<LatexMathematical
       Expression>}
```

E.g. A Text called "title" containing the Text "XY-Graph" is:

```
title=XY-Graph
```

Of Course, it could be written inside Braces:

```
title={XY-Graph}
```

Where it can also accommodate an Equation:

E.g. A Text called "title" containing the Text "Linear Equation" in BoldType with an Equation $y = 2 \cdot x$ is written as:

```
title=
   {\textbf{Linear Equation} $y=2\cdot x
       $}
```

43.6.1 The axial Settings

Inside the Settings of the "Axis"-Environment there are few common Elements that are important to consider. Some of these have also the Capacity for a different Style, given by the Key "style" equated with a String. Of Course the Elements are "comma"-separated.

• **Title**: it is created with the Key **"title"** equated with a TextMath.

• **Axial Labels**: are created with the Keys **"xlabel"**, **"ylabel"** and **"zlabel"** equated with TextMath.

• **Grid**: it is created with the Key **"grid"** and describes a rectangular or polar Grid, determined from the AxialSystem. The Grid can be colored via a Style, I use Orange as favorite on Sundays. The Style is declared before the KeyActivation.

• **AxisLimits AKA PlotBounds**: are the Values of the spatial Extension of the Plot. these are **xmin, xmax, ymin, ymax,** each one equated with a Value.

• **AxisLines**: are Keys that allocate or hide one or any Axis to particular Location within the Plot. The Purpose of such a Mechanism is to have non symmetrical Axes. The Key used is called **"axis"** [8] . The Values that an Axis can get are **"box", "top","middle","center", "bottom", "none"**. E.g. `axis x line=none` hides the "x"-Axis.

• **Ticks**: are created with the Keys **"xtick", "ytick", "ztick"** and there can be a Customization of their Distance, minor or major Ticks, or even left empty.

•• **Distance**: use the Key **"distance"** equated with a numeric Value or with the Command **"\empty"** to determine a Distance between the Ticks. Alternatively and for non linear Separations use Braces and a "Comma separated"-List of Values. E.g. `xtick={0,1,2,5,10,20,50,100}`.

•• **Minor Ticks**: are smaller Strokes, where are declared as `minor tick num=<Value>` for all Ticks, or `minor <B> tick num=<Value>` for any other Axis, where "B" is "x", "y" or "z".

•• **Sizes of Numbers on the Axes**: they can be adjusted by using either:

`ticklabel styles={font=<SizeCommand>}` for both Axes or

`B tick label style={font=<SizeCommand>}` for one axis x, y, or z.

• **ColorBar**: a ColorBar can be added in a Plot sidelines by using the Key **"colorbar"**.

• **ColorMap**: a ColorMap can be associated with the Plot by using the Key **"colormap"** with a the Name of the ColorMap in Use.

[8] This is an Extension created by **Pascal Wolkotte** (Hi Pascal!), see "pgfplots" Manual.

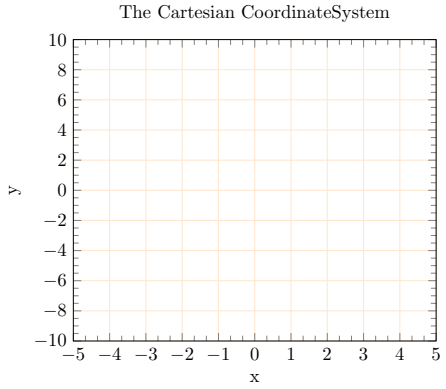


Figure 43.3: The Cartesian CoordinateSystem

E.g. `colormap name = greenyellow` for a “Brazil”-ColorMap.

It is now Time to demonstrate some of the Settings mentioned.

```
\begin{figure}
   \centering
   \scalebox{0.7}
   {
      \begin{tikzpicture}
         \begin{axis}[
            title={The Cartesian
                 CoordinateSystem},
            grid style={color=orange!20!
                 white},
            grid,
            xlabel={x},
            ylabel={y},
            ymin=-10,
            ymax=+10,
            xmin=-5,
            xmax=+5,
            xtick distance=1,
            minor x tick num=2,
            ytick distance=2,
            minor y tick num=3
            ]
         \end{axis}
      \end{tikzpicture}
   }
   \caption{The Cartesian
        CoordinateSystem}
   \label{fig:DemonstrationCartesianN1}
\end{figure}
```

which will give Figure 43.3.

43.6.2 ColorMaps

Some available ColorMaps are in pgfplots are:

- viridis
- hot
- hot2
- jet
- blackwhite
- greenyello
- violet

To create a ColorMap for your own sinister Colors, you can declare a

```
\pgfplotsset
   {colormap={<ColorMapName>}
      {<ColorSequence>}}
```

where

```
<ColorSequence>:=rgb(<Length>)=
   (<RGB>)[";" rgb(<Length>)=(<RGB>)]
```

and

```
<Length>:=
   <Size of SpectrumLengthPart in
        Spectrum>

   <RGB>::=(<Number>,<Number>,<Number>)

   <Number>::=[0,255]
```

E.g. The following Code creates an “arctic”-ColorMap:

```
\pgfplotsset
   {colormap={Arctic}{rgb255(1cm)
         =(0,128,255);
            rgb255(1cm)=(255,0,255)}}
```

Using the Function is easy, see the Figure 43.4.

```
\begin{figure}
   \centering
   \scalebox{0.7}
   {
      \begin{tikzpicture}
         \pgfplotsset{
            colormap={Arctic}{
               rgb255(0cm)=(0,128,255);
               rgb255(1cm)=(255,0,255)}
         }
         \begin{axis}[
            title={The Function $2\cdot x
                 -0.2\cdot x^2$},
            grid style={color=orange!20!
                 white},
            grid,
            colormap name=Arctic,
            colorbar,
            xlabel={x},
            ylabel={y},
            ymin=0,
            ymax=+10,
            xmin=0,
```

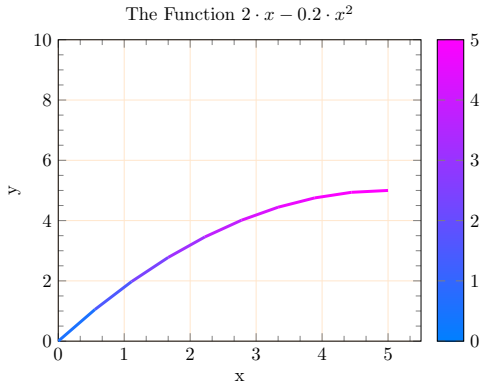


Figure 43.4: The Function $2 \cdot x - 0.2 \cdot x^2$

```
            xmax=+5.5,
            xtick distance=1,
            minor x tick num=2,
            ytick distance=2,
            minor y tick num=3
            ]
            \addplot[domain=0:5, samples
                =10, mesh,ultra thick
                ]{2*x-0.2*(x*x)};
        \end{axis}

    \end{tikzpicture}
  }
  \caption{The Function $2\cdot x-0.2\
      cdot x^2$}
  \label{fig:DemonstrationColorMap}
\end{figure}
```

The latter Command, “addplot” is used for plotting the Function, and is in the next Section explained.

43.7 The FunctionPlot with “addplot”

The FunctionPlot is conducted by the “addplot”-Command. This Command is obviously large in Options and has various Variants. As always, we run to the “First Aid”-Kit and grab the Vaseline. Ouch.

The “addplot”-Command has the Form:

```
\addplot[<Options>]<DataGenerator>;
```

There is also a three dimensional Version called “addplot3” which is a scalable Version of “addplot”.

Notice that the Command is terminated with Semicolon.

The “addplot”-Command can populate the same CoordinateSystem, that is, there can be more than one Curves within a Plot. Just stack them one after the other.

The DataGenerator can be Tuples, Triplets, DataFile, mathematical Expression or parametric Equations.

43.7.1 The Options of “addplot”

The Options within both versions of the Command are mostly the same and a few common and are:

- **Samples**: it determines the DataAmount appearing in a Plot as Points. It has the Key “**samples**” equated by a Number.
- **Smooth**: provides a smooth Interpolation between the Values of Data, so that you can convince your Boss that the FlightPath of the Aircraft will be nice. Please remain with your Belt seated with a Bag ready.
- **Mark**: it determines the MarkType and Color of a geometrical Point appearing in the Plot as Datum. It has the following Options:
  - **MarkShape**: this is done by equating the Key “**mark**” with the Symbols ***, x, +, -,o, cube** (for “addplot3” only). It is unlikely that you will use all these Symbols and actually this is only a minor Subset of Markers to serve even the most disturbed Mind (mine).
  - **MarkColor**: this is done by associating the Key “**mark**” with the Key “**color**” and then equating with a Name of “xcolor”-Palette. However it works with Markers that allow within Color! To keep your Hair [9] , use for the colored Markers the Expression:

[9] not like the Author who lost them because of YOU!

```
\lstinline{mark options={draw=<Color>}}
```

  - **No Lines but Marks**: this is done by using the Key "**only marks**".
  - **Scattered colors on Markers**: this represents the Markers according to a Color derived from a ColorMap. Use the Key "**scatter**".
  - **Scale of Mark**: use the Option "**scale**" equated with a Number, such as "`mark scale=2`".

- **Color**: it determines the LineColor of the Curve using the Key "**color**" equated with an "xcolor"-Value, or just enter the "xcolor"-Value.
- **Domain**: the mathematical Expression can have a Domain of Values of the independent Variable predefined using the Key "**domain**" equated with a ValuesRange. E.g. "`domain =-3:0.1:3`".

43.7.2 "addplot"-DataGenerators

To generate Data for the "addplot"-Command you have some nice Options:

- CoordinateValues: Here you use pure Tuples or Triplets to populate the Plot.
- DataFile: Here you have your Data in a "dat"-File and you access it.
- Algebraic Expression: Here you use an algebraic Expression to populate the Plot.
- Parametric Expressions: Here you use algebraic Expressions for each Axis.

43.7.2.1 CoordinateValues for "addplot"

CoordinateValues use a Set of "Parenthesis"-enclosed Coordinates within Braces. It has the Form:

```
\addplot"["<Options>"]"
coordinates "{("<x,y>")"
   [ "("<x,y>")" ] "}";
```

Notice that there is no Delimiter within each ParenthesisPair. This Error, though is seems Trivial, is of problematic Nature, because many ComputerAlgebraSystems use Comma as Delimiter. Please, remain alert with such Problems.

E.g. `\addplot[mark=+]{(2,9)(3,2)` };

43.7.2.2 "addplot" with DataFile

The "addplot"-Command can take at its Input a DataFile having an Extension of "**dat**". The Command is given as:

```
\addplot table {<FileName.FileExtension
    >};
```

[10]

The DataFile is commented within with # or %. Data are TextLines meaning Rows where a "Space"- or "Tab"-Character separates Values for denoting Columns. In the Example listed, the File YvsX.dat provided next will be opened and displayed as a graph.

```
%First Column is x, second Column is y,
     TabCharacter separates Data.
0  0
1  1
2  4
3  9
4  16
5  25
6  36
```

The Code to display the Plot of the File is here:

```
%Demonstrates the Ploting of a DataFile.
\begin{figure}
\centering
\scalebox{0.7}
{
   \begin{tikzpicture}
      \begin{axis}[
         title={Input from DataFile},
         grid style={color=orange!20!
              white},
         grid,
         xlabel={x},
         ylabel={y}
         ]
         \addplot[
```

[10] According to Dr. Feuersänger the "table"-Command is identical with "file"-Command where "file" is deprecated.

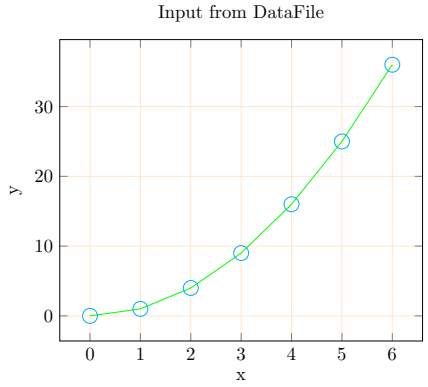


Figure 43.5: Input from DataFile

```
        color=green,
        mark options={scale=2, draw=cyan
            },
        mark=o
        ]
        table {Part_Latex/GraphsPgfplots
            /YvsX.dat};
    \end{axis}
  \end{tikzpicture}
}
\caption{Input from DataFile}
\label{fig:DemonstrationCartesianN3}
\end{figure}
```

Since you will probably generate a DataSet in a File, is more probable to use this Form of the "addplot"-Command, than anything else.

43.7.2.3 Algebraic Expression for "addplot"

An **algebraic Expression** uses the fundamental Operators as well the Functions:

abs, acos, and, and, array, asin, atan, atan2, bin, ceil, cos, cosec, cosh, cot, deg, depth, dim, div, divide, e, equal, factorial, false, floor, gcd, greater, height, hex, Hex, int, ifthenelse, iseven, isodd, isprime, less, ln, log10, log2, max, min, mod, Mod, neg, not, notequal, notgreater, notless, oct, or, pi, pow, rad, rand, random, real, rnd, round, scalar, sec, sign, sin, sinh, sqrt, tan, tanh, true, veclen, width.

These Functions are described in the Document "The TikZ and PGF Packages Manual for version 3.1.9a" from Mr. Till Tantau (Hi Till!) (Institut für Theoretische Informatik Universität zu Lübeck [11]) and are followed by a Parentheses as well as Parameters.

The following Examples demonstrate the Functions and the algorithmic Capacity of the "addplot"-Command. As always, you should be careful to choose the best Solution for your mathematical Endeavor, and not necessary this Package, which by the way is excellent.

43.7.2.3.1 "addplot" and Exponential Function The following Code creates an Exponential Function. This is shown in Figure 43.6.

```
\begin{axis}[
   title={The Cartesian CoordinateSystem
       },
   grid style={color=orange!20!white},
   grid,
   xlabel={x},
   ylabel={y},
   ymin=0,
   ymax=23000,
   xmin=0,
   xmax=10.5,
   y tick label style={font=\tiny},
   xtick distance=1,
   minor x tick num=5,
   ytick distance=1000,
   minor y tick num=5
   ]
   \addplot[
   color=green,
   mark options={scale=2, draw=cyan},
   mark=x,
   domain=0:10,
   samples=10]
   {exp(x)};
\end{axis}
```

It is obvious, that the small output Values of the Function are not shown. A Solution is to use the "semilogyaxis"-Command to plot the half logarithmic Plot. The Code for this Plot is shown here:

```
\begin{semilogyaxis}[
   align=center,
   title={The exponential Function $y=f(x
       ):=e^x$\\
      in semilogarithmic Plot on ``y''-
          Axis.\\
      Jim if you read this don't come
          home!},
   grid style={color=orange!20!white},
   grid,
   xlabel={x},
```

[11] Lübeck besides of great academic Performance provides *excellent* Marzipan, the best on the Planet. Forget Latex for a Moment: you need Marzipan.

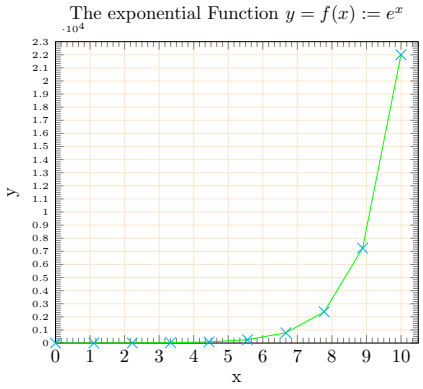


Figure 43.6: The exponential Function $y = f(x) := e^x$.

```
    ylabel={y},
    ymin=0,
    ymax=50000,
    xmin=0,
    xmax=10.5,
    y tick label style={font=\tiny},
    xtick distance=1,
    minor x tick num=5,
    ytick distance=10,
    minor y tick num=5
    ]
    \addplot[
    color=green,
    mark options={scale=2, draw=cyan},
    mark=x,
    domain=0:10,
    samples=10]
    {exp(x)};
\end{semilogyaxis}
```

Its Figure is shown here in 43.7.

A Word of Caution. In the first (linear) Plot, the maximum Value on "y"-Axis is ymax=23000, while in the second (half logarithmic) Plot, the maximum Value on "y"-Axis is 50000. Accordingly the "ytick"-Distance is 1000 and 10. So why? The Answer has to do with the Depiction of logarithmic Values. The Logarithm used has a Base "10" and is used logarithmically until the Cycle "50000". The DataCrosses correspond to the output Cycles of the Logarithm and not to the Input-Values. If you don't get this Paragraph, read the Section of Logarithms within this Book.

The "align=center"-Command is used for arranging the Alignment of Text in the Title of the Plot. Without it, the

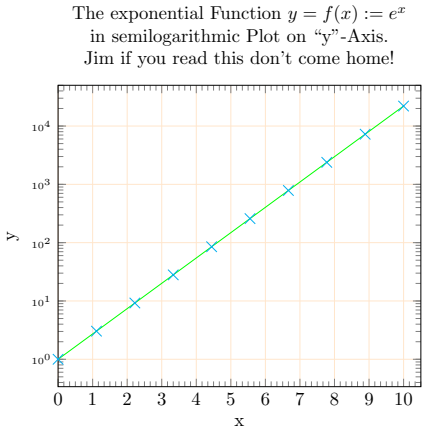


Figure 43.7: The exponential Function $y = f(x) := e^x$ in semilogarithmic Plot on "y"-Axis.

"newline"-Command \\ does not work!

Now get away from my Sight. I want to see interesting Things in Life.

43.8 Real NumberLines

Sometimes arrives the Demand for a really real RealnumberLine (I always wanted to say that, don't you?). This might be difficult at a first sight, but after loosing an Evening, a Marriage, Hair, and a Packet of Viagra™I found that actually there is a Solution.

In Figure 43.8, the "y"-Command arranges the Size of the "y"-Axis of the Plot. Here it has a Value of "0.5". The "y"-Axis is hidden ("none"), while the "x"-Axis is centered. The "xticklabel" is set "empty" so that no Numbers appear. The `xtick align=outside` is used for Location of "xticks" outside the Axis.

```
\begin{axis}[
    title ={Empty NumberLine},
    y=0.5cm,
    axis x line=center,
    axis y line=none,
    xmin=0,
    xmax=5,
    ymin=0,
    ymax=1,
    ticks=none,
    xlabel={$x$}
    ]
```

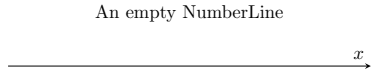


Figure 43.8: An empty NumberLine.

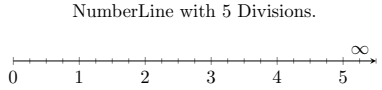


Figure 43.9: NumberLine with 5 Divisions.

```
\end{axis}
```

In the next Figure 43.9 there is a numbered NumberLine, this time with the Numbers from 1 to 5 with Subdivisions of 3. It has the Label Infinity as with its Symbol, ∞. Its Code is here:

```
\begin{axis}[
   y=0.5cm,
   title ={NumberLine with 5 Divisions.},
   axis y line=none,
   axis x line=center,
   yticks=none,
   xtick distance=1,
   minor x tick num=3,
   xmin=0,
   xmax=5.5,
   ymin=0,
   ymax=1,
   xlabel={$\infty$}
   ]
\end{axis}
```

In the next Figure, there is the same NumberLine now populated with Data. Here the Line is orange, and only marks are denoted. The Coordinates for the "y"-Axis are in the $y = 0$ Range.

```
\begin{axis}[
   y=0.5cm,
   title ={NumberLine with Data},
   axis y line=none,
   axis line style={orange},
   axis x line=center,
   xtick align=outside,
   xmin=0,
   xmax=5,
   ymin=0,
   ymax=1,
   xlabel={$\infty$}
   ]
   \addplot+[mark options ={scale=2, draw
        =blue}, mark=*, only marks]
        coordinates  {(0,0)(1.5,0)(2.3,0)
        (3,0)(4.7,0)};
\end{axis}
```

In the next Figure 43.11, there is a NumberLine with a ValuesDomain denoted as

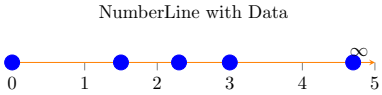


Figure 43.10: NumberLine with Data

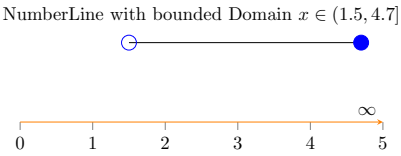


Figure 43.11: NumberLine with bounded Domain $x \in (1.5, 4.7]$

an Open- and Closebound, i.e. $x \in (1.5, 4.7]]$

```
\begin{axis}[
   y=1.5cm,
   title ={NumberLine with bounded Domain
        $x \in (1.5, 4.7]$},
   axis y line=none,
   axis line style={orange},
   axis x line=center,
   xtick align=outside,
   xmin=0,
   xmax=5,
   ymin=0,
   ymax=1,
   xlabel={$\infty$},
   nodes near coords=
   ]
   %LinePlot
   \addplot[mark options ={scale=2, draw=
        blue}] coordinates  {(1.5,1)
        (4.7,1)};
   %Openbound
   \addplot[mark options ={scale=2, draw=
        blue}, mark=o, fill=white, only
        marks] coordinates {(1.5,1)};
   %Closebound
   \addplot[mark options ={scale=2, draw=
        blue, fill=blue}, mark=*, only
        marks] coordinates {(4.7,1)};
\end{axis}
```

Though exists a Package in Latex that does this Job perfectly, so good that I don't remember it, perhaps you might encounter a piecewise Function that will give you endless Hours of Hedonism, so grab the Vaseline and relax: the Pain will be short. Here is an Example.

```
\begin{axis}[
   title ={Piecewise Function with a
        Discontinuity in $x=3$},
   grid,
   xmin=0,
   xmax=5,
   ymin=-20,
```

```
    ymax=130,
    xlabel={$x$},
    ylabel={$y$},
    ]
    %Case 1: f(x)=x^3+10
    \addplot[domain=0:3, color=blue]{x
        ^3+10)};
    %Case 2: f(x)=x^3-10
    \addplot[domain=3:5, color=blue]{x
        ^3-10)};
    %Openbound at (3,37)
    \addplot[mark options ={scale=2, draw=
        blue, fill=white}, mark=o, only
        marks] coordinates  {(3,37)};
    %Closebound at (3, 17)
    \addplot[mark options ={scale=2, draw=
        blue, fill=blue}, mark=*, only
        marks] coordinates  {(3,17)};
\end{axis}
```

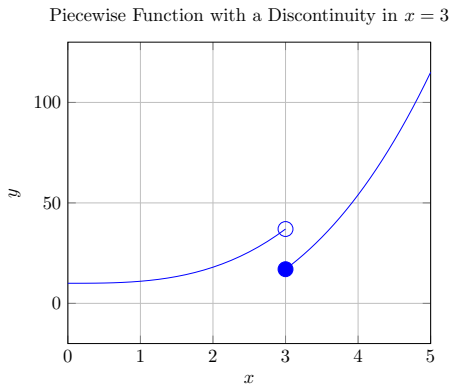


Figure 43.12: Piecewise Function with a Discontinuity in $x = 3$

The End

I hope not! But I hope to publish something else if Time permits.